Study

MARINE AND SAFETY TRAINING IN THE EASTERN CANADIAN OFFSHORE PETROLEUM INDUSTRY

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MARINE AND SAFETY TRAINING IN THE EASTERN CANADIAN OFFSHORE PETROLEUM INDUSTRY

A STUDY FOR THE ROYAL COMMISSION ON THE OCEAN RANGER MARINE DISASTER

PREPARED BY:

THE COLLEGE OF FISHERIES, NAVIGATION, MARINE ENGINEERING AND ELECTRONICS

ST JOHN'S, NEWFOUNDLAND

MAY 1984

AN EXECUTIVE SUMMARY HIGHLIGHTING
THE MOST IMPORTANT POINTS OF THE STUDY AND
GIVING THE CONCLUSIONS HAS BEEN PREPARED
AS A SEPARATE VOLUME

CONTENTS

		Page No
	ACKNOWLEDGEMENTS	
	LIST OF FIGURES AND TABLES	
1.	INTRODUCTION	1
1.1	Background to the study	1
1.2	Purpose and objectives	1
1.3	Scope of the study	3
2.	STUDY STRATEGY	4
2.1	Formulations of the study group	4
2.2	Definition of the study	4
2.3	Information collection procedures	5
2.4	Data analysis	6
2.5	Form of the report	6
3.	AN OVERVIEW OF TRAINING	8
3.1	Purpose and types of training	8
3.2	Management, control and funding of training	11
4.	THE MOBILE OFFSHORE DRILLING UNIT (MODU)	19
4.1	Types of MODU and associated hazards	19
4.2	MODU crew structures	24
4.3	Marine and safety training for MODU personnel	46
4.3.1	US requirements	46
4.3.2	Norwegian requirements	52
4.3.3	UK requirements	64
4.3.4	Canadian requirements	73
4.4	A comparison of the effectivenes of marine training	83
4.4.1	Basic safety training	83
	Conclusions	86
4.4.2	Specialist emergency training	88
	Conclusions	93
4.4.3	Marine crew	95
	Conclusions	103
4.4.4	Drilling crew	110
	Conclusions	112

Page No

5.	MARINE SUPPORT	119
5.1	Development of vessels and operations	119
5.2	Crew roles and training	121
5.3	Key personnel	123
5.3.1	Master	123
5.3.2	Mate	126
5.3.3	Boatswain and seamen	128
5.3.4	Chief engineer	130
5.3.5	Electronic technician	131
5.3.6	Diving personnel	132
5.4	The standby/rescue role	133
	Conclusions	136
6.	AIRCRAFT SUPPORT	139
6.1	Introduction	139
6.2	Helicopter crew	139
6.3	The training of helicopter crew	140
6.3.1	Qualification, training and experience	141
6.3.2	Emergency training	142
6.3.3	Comparison with other areas	143
6.4	Training for rescue work	143
6.4.1	Rescue operations	143
6.4.2	Rescue duties	144
6.4.3	Rescue training	145
6.4.4	Comparison with other areas	146
6.4.5	Discussion	147
	Conclusions	148
7.	GENERAL CONCLUSIONS	150

APPENDIX A - Organizations consulted

APPENDIX B - Glossary

APPENDIX C - Reference

LIST OF FIGURES

3.1 Training patterns

4.1 Manning of typical Norwegian drillship

4.2 Norwegian mandatory manning structure for semi-submersibles

4.3 USCG manning requirements for MODUs

4.4 General manning requirements for semi-submersibles

4.5 General manning arrangements for US operated jack-ups

4.6 Typical industrial crew

LIST OF TABLES

4.1 Hazards to MODUs

4.2 Training structure for drilling crew (Norway)

4.3 Offshore training institutions (Norway)

4.4 Offshore training institutions (UK)

4.5 Offshore training institutions (Canada)

SECTION 1 - INTRODUCTION

1.1 Background to the Study

In the early morning of 15 February 1982 the semi-submersible drilling unit 'Ocean Ranger' sank during a winter storm on the Grand Banks of Newfoundland. The location, well J.34 in the Hibernia field, is approximately 175 nautical miles east of St John's. Conditions at the time were severe - low temperatures, high winds and heavy seas. During the night, problems in operating the ballast control system were reported. Distress messages were sent, the final one of which stated that the unit was being abandoned by lifeboat. Despite the efforts of two standby vessels, commercial helicopters and Search and Rescue, all 84 persons aboard perished.

On 18 March 1982, a Royal Commission of Inquiry was announced jointly by the Governments of Canada and of Newfoundland and Labrador. The comprehensive Terms of Reference required the Commissioners, in addition to inquiring into the loss of the 'Ocean Ranger', to investigate the marine and drilling aspects of practices and procedures in the offshore drilling industry in Eastern Canada including certification, training and safety of persons on drilling units and support craft (Royal Commission 1982).

In August the Commission requested the College of Fisheries, Navigation, Marine Engineering and Electronics (the College) to undertake a study and assessment of these areas. The purpose and objectives for the study were agreed in late August, and the project began on 7 September 1982.

1.2 Purpose and Objectives of the Study

The purpose of the study was to examine and assess operational marine, emergency and safety training for the offshore petroleum industry and its related support activities. It was to be performed under Part 2 of the terms of reference for the Royal

Commission on the Ocean Ranger Marine Disaster, to provide the Commission with information on current practices in training in Canada and other countries with offshore oil exploration activity.

The objectives of the study were:

1) To examine the training needs of the personnel involved in offshore petroleum operations in four major categories:

   i) the training of all personnel in safety and survival (basic emergency training);

   ii) the additional specialist training required by persons with designated safety responsibility in an emergency;

   iii) the training needed by persons, over and above their normal industrial, marine or aviation vocational training, to enable them safely to work on a MODU or its support craft;

   iv) the training of marine and aviation personnel in rendering assistance following an incident.

Figure 3.1 relates the four training categories to the personnel on MODUs, their support craft and support helicopters.

2) To describe and compare current practices in Canada and other regions for the training, certification and skill maintenance of persons in the categories referred in (1) above.

3) To assess the adequacy of current training practices and to draw conclusions as to any outstanding needs for the training of personnel working in the Eastern Canadian offshore region.

1.3 Scope of the Study

The area of concern is the Eastern Canadian Offshore extending from the shoreline to the limits of jurisdictional claims. The area extends from the Canada - US boundary north to the limit of areas which will be serviced from East Coast ports and use marine drilling systems (approximately 75° N).

Activities to be covered included exploration and delineation drilling from mobile offshore drilling units, marine support including supply and standby duties and helicopter transportation. Although shore support personnel are an important element of an overall safety and emergency response system, their training was not considered in the report.

Training in other countries was examined for three reasons: as a comparison between Canadian practices and those of established offshore oil countries; because these countries are the primary flag states of many drilling units and support vessels working in Eastern Canada offshore, Canadian requirements may be overlaid on the requirements of the flag states; and because the offshore oil industry is international, many of the persons engaged may already have received training in these countries.

It is important to note that most of the data used in the report were collected prior to the end of spring 1983. Improvements have been made in the past year in areas of marine survival and safety training for the Eastern Canadian offshore petroleum industry.

SECTION 2 - STUDY STRATEGY

2.1 Formulation of Group

The main expertise within the College of Fisheries, Navigation, Marine Engineering and Electronics of relevance to the study is in the training and certification of officers and crew of all grades, and in training mariners and others in Marine Emergency Duties. The President of the College, Dr C R Barrett, was the Director of this Study, and Captain J J Strong, normally Head of Nautical Science Department (MOT Branch), was leader of the Project Group. To provide expertise in the other aspects of the study, three consultants were retained. Mr D H Williamson has extensive experience in the safety and training aspects of drilling, both onshore and offshore, and in the production and refining of petroleum. Captain S J Hynes is actively involved in offshore marine support and was Master of a dynamically positioned diving support vessel. Mr D Bazeley has experience in the design and development of training and educational materials, and in editing of technical reports.

Hollobone Hibbert and Associates Limited of London was retained to produce the final draft. This organization is experienced in technical report writing, and has in-house knowledge of offshore operations and related safety training practices in the established oil-producing areas of North West Europe.

2.2 Definition of Study

The first stage of the study was to review offshore petroleum industry operations, support operations, the operational environment and the hazards present. This produced a list of operations, personnel and contingencies about which information on duties, qualifications and training was required.

The next stage was to identify and list likely sources of information. The main sources were marine and petroleum industry training centres, oil companies, drilling and service companies, government agencies and search and rescue organizations. The

resulting extensive list of organizations was then reduced to a cross-section of sources for both Canada and other jurisdictions. In selecting the cross-section the relevance of the organizations to Eastern Canadian operations and their reputations as leaders in their respective fields were considered.

2.3 Information Collection Procedures

Four main procedures were used to collect the required information: literature and database searches, request by mail, request by telephone, and visits. The sources from which information was required when matched against these procedures determined the most appropriate for each source.

In many cases the information was of a subjective nature best addressed through a visit. This was particularly so for training courses where the facilities and style of teaching are only rarely described objectively in print.

Altogether, 73 organizations were visited between October 1982 and April 1983 in Canada, the United States, the United Kingdom, Norway and the Netherlands. Meetings and telephone conversations were held with representatives of 22 organizations, and information was obtained by mail from 14 others.

Additional information was obtained from the public hearings of the Royal Commission, the report of the United States Coast Guard/National Transportation Safety Board hearing, and from literature searches requested through the Commission's Information Centre. The various consultants to the Commission and the other contract study groups were also valuable sources of information.

A full list of organizations providing information appears in Appendix A.

2.4 Data Analysis

Because of the descriptive nature of the data, formal analysis procedures were limited. The basis of the analysis was that there are three aspects of the training of personnel to promote overall safety in offshore operations; individual job training in safe working practices, the general training of personnel in basic survival, first aid and elementary emergency duties, and the training of personnel having designated or well defined functions in emergency situations, especially those with command or decision-making responsibilities.

Having categorised the personnel and their various functions, the training situation was assessed. A three step approach to this was taken. Firstly the function was broken down into skills necessary. Secondly, the training available was established (the attempt was made to include not only formal training but also experience, on the job training and expected career paths). Thirdly, a comparison was made between the skills required and the level of training available. Thus, where appropriate, a gap in available training was identified and conclusions were drawn as to its importance. Practices and standards in other jurisdictions and operating areas were considered when drawing conclusions.

2.5 Form of the Report

The outline of the final report was developed in consultation with the Commission's Director of Studies. The subject areas of the study fall naturally into various discrete categories, and the report is organized on this basis.

Section Three gives an overview of training in the offshore petroleum industry - the definition and purpose of training, the types of training available and its management and control in various countries.

Section Four deals with the present focus of the offshore petroleum industry in the Eastern Canada region - the Mobile Offshore Drilling Unit (MODU). A brief description of the unit types,

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characteristics and potential hazards, and a description of the way in which the units are crewed is given. There are four sub-sections concerned with training in the US, Norway, United Kingdom and Canada. For each country basic emergency training, specialist emergency training, marine crew training and drilling crew training are described. A fifth sub-section compares the training of the key personnel in these countries and draws conclusions as to its relevance.

Section Five is concerned with Marine Support. The training of key members of the vessel crews are discussed in relation to the various duties these vessels are required to perform. The Standby/Rescue role is discussed separately within the section.

Section Six covers air support, excluding the Government's Search and Rescue service. The section is divided between training for safety in normal operations and training for search and rescue operations.

Sections Four, Five and Six contain conclusions on MODUs, Marine Support and air support respectively. Section Seven gives general conclusions, valid for all training.

A number of Appendices are included for relevant background information.

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SECTION 3 - AN OVERVIEW OF TRAINING

3.1 Purpose and Types of Training

Definitions

The teaching of personnel in the industrial setting can be broadly grouped into: Training - activities designed to improve performance of a specific job (present or imminent) or set of tasks; Education - activities designed to improve general knowledge and overall competence in a specific direction beyond the present or imminent position; and Development - activities to help the individual adapt to changes in the organisation (adapted from Lastra and Nichols 1981). This study was limited to training.

Reasons for Training

In any industry, training is necessary so that personnel can perform their duties safely and effectively. As individuals progress up through a company, or change from one workplace to another, there will be changes in their duties or in the equipment and systems they must operate. Technology also changes with time, as do company procedures and structure. This means that most personnel need continual training throughout their career, even if they remain in the same job.

The offshore petroleum industry needs highly competent personnel. Investments in drilling units and wells are enormous, and to jeopardize both that investment and the welfare of other personnel on the vessel, through the employment of inadequately trained operators is both uneconomic and unacceptable. Most companies recognize this, and ensure both through hiring practices and training that only competent people work in this field.

Emergency training is sometimes considered differently. It does not enhance the employee's contribution to the project when the job is progressing normally. But employers have an obligation not only to protect their personnel from workplace hazards, but

also to enable them to help themselves in the event of emergencies at the workplace. This aspect makes emergency training at least as important as operational training.

Figure 3.1 shows the relationships between the various training patterns for persons on MODUs and their support craft.

Means of Training

The offshore oil industry and its related sectors use a wide variety of ways to train employees from individual company programs, through co-operative groups, to government operated training institutions. For operational personnel, there is a strong preference for short programs dealing with a specific aspect, or for longer programs to be divided into short segments. The oil industry prefers the maximum length for attendance at onshore courses to be one week (30 - 50 hours), which can be fitted into the period between tours of offshore duty.

Onshore Training

This can be theoretical training in classrooms, workshops, and on simulators, or practical training for emergency situations which could not be done offshore in safety (live firefighting, survival etc). Marine colleges, private specialized training groups, company-operated training centres, and even military facilities are utilized.

Offshore Training

The drilling industry traditionally operated by on the job training (OJT). However, as Adkins and Coleman (1978) indicated, having to learn the intricacies of a job while being expected to do it means that a new employee's mistakes can be costly. With the complexity of modern offshore drilling units, and the number of people aboard, these costs are potentially very high, in terms of human life and dollars.

Although there is a growing acceptance of onshore training, there is still a strong feeling that training on the unit is necessary.

The equipment and the unique aspects of the unit are all in place in a realistic setting. Training offshore has four forms: on the job under supervision, teaching by visiting instructors, self-instruction, and drills and exercises.

On the job training undoubtedly can be very effective if well managed, but also has many disadvantages. Primary among these is the difficulty of controlling the training, both in content and instruction, and the risks mentioned above.

It is quite common in many areas, such as crane operation, for equipment manufacturers' or suppliers' personnel to give individual instruction to operators. A problem with this approach is that off-duty personnel, after a 12-hour tour, perhaps working hard outdoors in bad weather, are exhausted. After a shower and a meal, it is virtually impossible to keep their attention for a training session, even if they are well motivated. Also there is always a risk of their having to miss instruction to attend to extra duties.

Self-instruction is today a very popular system. A variety of media (videotape, slide-tape presentations and workbooks) are available, and many are packaged in quite lengthy programs of study, for example the International Association of Drilling Contractors (IADC) Rotary Drilling series from the Petroleum Extension Service of the University of Texas at Austin (PETEX). These can be used for individual study or for guided programs administered either by supervisors offshore, by the company or training department, or the originating organization onshore. High standards can be achieved in this way, provided that the material is of good quality and that its use by the trainee is diligent. Thorough evaluation of the trainee's learning is very beneficial in ensuring this second requirement, and some companies find that financial inducement schemes are effective.

These three methods of training offshore are frequently used in combination to produce an overall training program. Such programs are most frequently encountered in the larger drilling contractors where the senior management is committed to its success and where it is administered by a training department.

There is usually a requirement to complete the next step of the program as a pre-condition for promotion. The last type of offshore training is usually a legal requirement - drills. These are mainly concerned with emergency actions and should have two aspects: refreshment of existing knowledge and skills, and application to cope with unexpected developments. Authorities generally require four types of drill: fire, abandon vessel, man overboard and blowout.

Integration of Safety Training

Many companies reported that safety is an inherent aspect of their skill or occupational training. Generally speaking this refers to the immediate personal safety aspects, such as working on moving machinery or live electrical equipment. The effects of working and living offshore are more frequently dealt with separately.

'Safety training' is used by some companies to refer to what is called in this report emergency duties training - fire fighting, first aid, abandonment, survival and rescue.

3.2 The Management, Control and Funding of Training

In most of the developed nations, employers are obliged to ensure that a workplace is as safe as possible, in terms of design, operation and the competency of the employees. Where the offshore petroleum industry operates under such jurisdictions, this obligation is usually placed on the concession operator (the oil company) or the owner of the facility (MODU). Government's main duty is to ensure that employers fulfill their obligations in respect to hazards of living and working on an isolated platform at sea.

Training in marine industries is quite closely regulated in most countries, and is tied in with certification of persons. This is not generally the case for marine personnel of mobile offshore drilling units (MODUs) unless they are registered as ships. An exception to this is Norway, which in the last three years has

brought out regulations covering the training of marine personnel on all its MODUs. The USA has special certificates for MODU marine personnel, but these are more limited in application and less stringent in their requirements. The UK and Canada have no special MODU certificates.

An overview of the four countries studied reveals that there is considerable diversity, particularly in the degree of co-operation between various sectors of Government and the industry. There is little reciprocal acceptance of certification between the countries.

The United States of America

The offshore petroleum industry began in the USA, and the biggest oil companies and drilling contractors are based there. In respect of training, the industry is largely self-regulating. Governmental control extends only to well control training, to requirements for lifeboatmen and to the certification of the person in charge of the MODU. There are no regulations covering emergency training other than for standard drills (Safety and Offshore Oil, 1981).

The two major groups which set industry standards are the American Petroleum Institute (API) and the International Association of Drilling Contractors (IADC). Both have established guidelines in many areas of offshore operations, and although these have no legal standing and there are no enforcing agencies, most companies follow them. API and IADC are also main avenues for discussion of regulations. All interested parties must be consulted before legislation is enacted.

US drilling companies make considerable use of the educational sector. Also, API and IADC have co-operated with groups like PETEX, the Petroleum Extension Service of the University of Texas at Austin, to develop courses for any company who wishes to use them. The standing of these courses is such that Government has not felt it necessary to formally approve them.

Industry in the USA has not adopted basic emergency training for all offshore personnel. There are no guidelines from API or IADC, and very little training is available, other than in hydrogen sulphide (H_2S) detection and safety measures and firefighting. Short training courses are available in lifeboat work, but these are only attended by selected personnel. Boat and fire drills are required to be held on board.

Most training establishments are funded by course fees. Even universities do not solicit funding from industry for the provision of facilities.

Norway

Until 1980, the Norwegian Government 'left the responsibility to the operating companies to see that their personnel were given the required training' (Skarstein, 1980). This is still the case to some extent, although in three critical areas training is now regulated. These are basic emergency training, training for marine crews on MODUs, and drilling training. Courses must be approved by the Maritime Directorate (NMD), the Petroleum Directorate (NPD) and the education authorities. Generally the courses are paid for from Government educational funds.

Consultation with the industry is primarily through the Norwegian Operators' Association (NIFO). Much is done by directive rather than by regulation, although in Norway industry is subject to more regulations than in other nations. Norway has attempted to provide much of the offshore training in its existing technical and maritime schools. 'Local forums' provide for discussion between industry and the educational establishments.

Industry has co-operated to quite a high degree in implementing training requirements in Norway. An example is the industry's funding of a dedicated fireground and survival craft platform at Statens Havarivernskole (the Norwegian Academy of Sea Rescue and Damage Control). This was under construction for maritime training when the government introduced the requirement for offshore personnel. NIFO members advanced $6 million to provide

the facilities for MODU training. Other maritime schools which give basic emergency training have received funding from companies based in their area. Some company schools are also approved by Government.

Another good example of industry/government co-operation is the development of courses to qualify personnel for maritime duties on MODUs. Government funded course development, and industry assisted initially by providing many of the instructors for the courses and by permitting other instructors to spend time on units.

The Norwegians have been willing to override, to a certain extent, the local control of education in response to national needs. Courses and facilities have been directed to the most strategic locations, at the expense of other areas, and the national government has established offshore related departments within locally operated schools.

The United Kingdom

Co-operative effort between industry and the educational sector is very evident in offshore training in the UK. Two agencies, the United Kingdom Offshore Operators' Association (UKOOA) and the Offshore Petroleum Industry Training Board (OPITB, formerly the PITB) are prominent at the national level.

UKOOA provides for industry liaison with government. Its Safety Committee has developed guidelines for offshore emergency safety training on installations (UKOOA, December 1980) and for offshore emergency drills and exercises on installations (UKOOA, August 1982), in order to set standards considered necessary for an employer to meet the requirements of legislation, particularly the Health and Safety at Work Act (1974), and the Mineral Workings (Offshore Installations) Act 1971.

The PITB was set up by the government under the Industrial Training Act 1964. It was funded by a levy on the industry. Its objective was to assist and encourage the development of training

for the industry. When most of the industry training boards (of which there were several) were dissolved, the offshore industry opted to continue funding its board and PITB became the OPITB.

The Board includes members from the offshore oil industry, labour organizations and educational institutions. The management steering group involves UKOOA, the North Sea Chapter of IADC, service companies and the government's Manpower Services Commission. OPITB is directly involved in operating the Fire School and the Drilling and Production Technology Centre at Montrose in Scotland.

Other training for the offshore industry is organized by two regional, non-profit industry associations: The Scottish Offshore Training Association (SCOTA), and the Petroleum Training Association (North Sea) (PETANS). Their members include all companies which have offshore workers and the training institutions which provide courses. SCOTA and PETANS act primarily as organizers, bringing together teachers and trainees as needed by industry, with courses approved by OPITB. They have also been instrumental in establishing facilities for training which may be used by, for example, a government institution to provide training for the industry.

SCOTA and PETANS do not have a monopoly. For example, the Offshore Survival Centre at Robert Gordon's Institute of Technology (RGIT) independently offers a number of courses for the offshore industry, which are acceptable by OPITB and government agencies.

There are also a number of specialist commercial schools offering training in single subjects such as crane operation and drilling.

<u>Canada</u>

Offshore training in Canada is still in its early stages, in comparison to Europe. Canadians employed on MODUs whether operating in Canadian waters or in other offshore areas have to be trained. To achieve this will need the combined efforts of the companies and the educational sector. Canada, compared to Norway and the UK, appears to lack an effective three-way

dialogue between industry, the educational establishment and the regulatory agencies.

The principal government agencies responsible for the offshore are the Newfoundland provincial Department of Mines and Energy and the Canadian Oil and Gas Lands Administration (COGLA) which acts on behalf of the federal Department of Energy, Mines and Resources and the Department of Indian Affairs and Northern Development. COGLA is assisted by other federal departments such as the Canadian Coast Guard (CCG) which provides marine safety expertise under a Memorandum of Understanding (COGLA, 1982) and the Canadian Employment and Immigration Commission (CEIC) in matters pertaining to the employment of Canadians and in implementing effective training and development programs. There is no federal department responsible for educational matters.

At the provincial level, these same agencies have sole jurisdiction for offshore matters except in Newfoundland where the jurisdiction dispute is still before the courts. The Newfoundland and Labrador Petroleum Directorate (NLPD) is the provincial equivalent of COGLA. The provincial Department of Labour which is concerned with the employment of Newfoundlanders works in conjunction with and carries out some inspections on behalf of NLPD. The Department of Education has the responsibility for training institutions and programs in the Province.

There are several industrial organizations: the Canadian Association of Drilling Contractors (CAODC); the Canadian Petroleum Association (CPA) which represents most but not all operators on the national scene, including east and west coasts and the Arctic region; and the Arctic and East Coast Petroleum Operators Associations (APOA and EPOA).

The Petroleum Industry Training Service (PITS) is an industry-governed non-profit training organization which has been providing industry since 1949 with upgrading training and supplements the company training for onshore drilling activities. Very recently PITS became involved in the offshore on the east coast.

There are a number of forums in existence, each of which excludes one or more of the interested parties. These are: the Petroleum Industry Training Service (PITS) East Coast Advisory Board (no educational representation); Marine Safety Advisory Committee (no representation of COGLA or NLPD); and Newfoundland's Offshore Petroleum Impact Committee (OPIC) (no federal government representation).

Provincial control over training leads to different standards being applied, particularly for basic emergency training, between Newfoundland and Labrador and Nova Scotia.

Companies with European affiliates which have been leaders in establishing programs in their own areas, well before any government requirements, have been reluctant to make similar commitments in Canada. The LEIRO recommendations for basic emergency training in Norway are based on the program which Mobil Exploration Norway Inc was operating in 1977 (NIFO, 1982, personal communication). In 1973, SEDCO was arranging for all new employees on its units in the UK North Sea to have twelve days' training in survival, first aid and firefighting (Drilling, 1972). This lack of standards, particularly in the area of emergency training, is being addressed in Canada, but universal agreement has not been reached to date.

Newfoundland and Labrador Petroleum Regulations (1977) require the operators to spend an amount of money on any combination of approved research, development, education and training. About a half of one percent of this total amount was spent on emergency training up to the end of 1982 (Newfoundland Department of Education, 1983).

Canadian standards should be developed to the highest international standards. This would not only help to ensure safe and efficient operations offshore Canada, but also assist Canadian nationals to work on foreign units and Canadian companies to obtain work in other countries. If the standards gained acceptance as equivalent to those of other nations little or no additional training may be required.

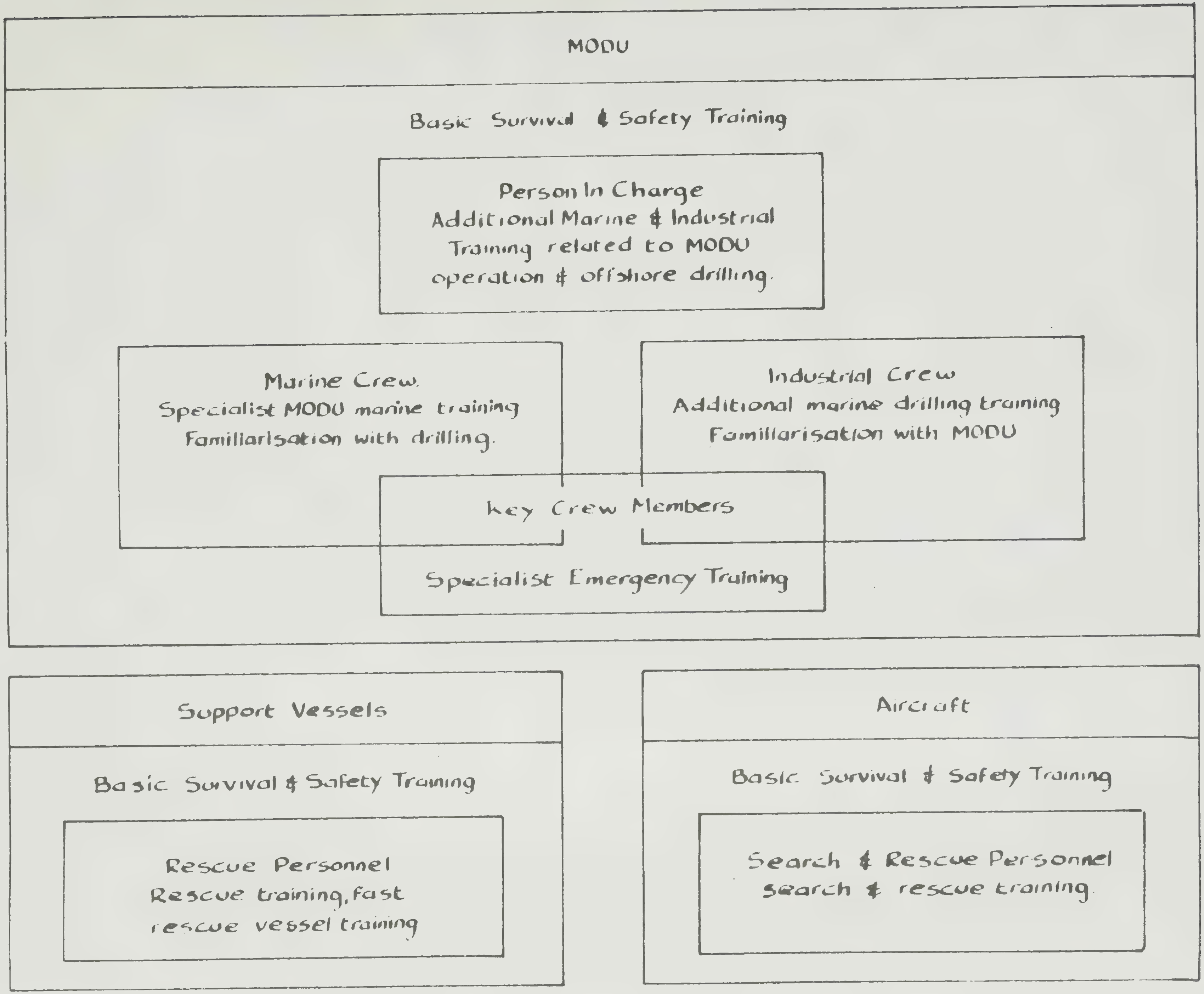

Fig. 3.1 Training Patterns.

SECTION 4 - THE MOBILE OFFSHORE DRILLING UNIT (MODU)

4.1 Types of MODU and Associated Hazards

Exploration wells are drilled offshore from units which may be moved between drilling locations, either under tow or by self propulsion, or sometimes when self-propelled, using the assistance of towing vessels. Once on location they remain in position by standing on the sea bed, or by means of multiple anchors, or by dynamic positioning. Three principal types of unit are used off Eastern Canada:

Jack-ups

The jack-up unit comprises a floating hull - usually nowadays roughly triangular - which carries the drilling equipment, machinery, supplies and accommodation. It is fitted with a number of retractable legs, now usually three, of lattice steel construction. Under tow (or more rarely self-propulsion), the legs are raised, until the bottom end is just below the hull. On location they are lowered to the sea bed, and the hull is elevated clear of the waves by means of a jacking system.

A jack-up provides an ideal stable platform for a drilling rig, but is limited by water depth - about 90 metres maximum in areas with reasonable weather conditions, less where severe wave conditions may occur. The lower ends of the legs are tailored to certain sea bed conditions. Where the bed is too soft, or very rocky, it may not be possible to use any type of jack-up.

Semi-submersible

A semi-submersible is a floating unit, comprising either a group of separate vertical columns, enlarged at the bottom end and braced together to form a floating body, or two or more submerged submarine-shaped parallel pontoons with a number of vertical columns. In either case the columns support a deck, carrying the

draft may be varied by flooding or pumping out buoyancy tanks in the columns or pontoons, to give shallow draft for least resistance under tow, or deep draft to bring the centre of buoyancy below the worst wave action for steadiness on location. Semi-submersibles are usually maintained on station by a spread of eight to twelve anchors, but may be dynamically positioned, although the large fuel penalty involved makes dynamic positioning less attractive if anchors can possibly be used. Semi-submersibles are often self-propelled between locations.

Semi-submersibles provide a stable platform to permit drilling in all but the most severe conditions.

Drillships

Drillships are formed of a ship-shaped hull, conventionally propelled. In the centre of the hull is mounted a drilling rig operating through an opening in the hull, known as a moonpool, which is large enough to enable equipment to be lowered from the deck to the sea bed. Drillships sail between locations like an ordinary ship, and are much more mobile than semi-submersibles. On location they may be anchored, but offshore Eastern Canada they have usually been dynamically positioned, a particular advantage when they may have to move quickly off location to avoid icebergs - only the drill string needing to be disconnected. Some drillships have the capability to drill in 800 metres of water depth.

A dynamically positioned drillship can be turned head into the weather, but even so provides a less stable platform than a semi-submersible, and must therefore cease drilling at an earlier weather state.

MAJOR HAZARDS TO MODUs

There is no one source from which details may be obtained for all major MODU incidents worldwide. In some areas, such as the North Sea, information is plentiful. In others, governments may not compile statistics, or may not release them.

Lloyds' Register of Shipping is probably the source of the most complete information on accidents. A number of analyses has been based on these records.

Hazards (and therefore accidents) fall into two classes - industrial and marine hazards.

Industrial hazards - The primary drilling hazard is a blow-out of oil or gas, either up the wellbore or outside the casing. A blow-out at the drill floor may ignite, causing an uncontrollable blaze and the loss of the unit although this is by no means inevitable (in 1975 a blow-out in the Norwegian Ekofisk field was brought under control, after blowing oil and gas for several days). A blow-out at the sea bed may cause aeration of the sea, with consequence loss of buoyancy of a floating unit. A floating unit may be able to cut the drill string and move away from a blow-out, as has been successfully done, but for a jack-up, this is not feasible.

Another rare but serious drilling incident is an emission of the highly poisonous gas H_2S from the wellbore, making the unit uninhabitable.

Other industrial hazards result from secondary activities, such as welding and cutting or lifting and handling. Some of these affect only those persons engaged in or associated with the activity but others may hazard the whole unit, by causing a fire or explosion. Any necessary training is in the industrial technique adapted where necessary to the offshore environment, for instance to familiarize an offshore crane operator with the particular hazards of unloading a heaving vessel.

Marine hazards - The operation of an industrial process in a marine environment presents a number of marine hazards above and beyond those encountered in normal shipping operations.

Accidents during the moving of the unit represent the highest percentage of all MODU mishaps; they also usually incur the greatest loss of life. Of particular concern is jacking up or

down. Two thirds of all towing accidents occurred in fine weather. As MODUs, particularly jack-up units, are usually only moved when the forecast is favourable, this accords with expectations.

Jack-up MODUs are especially vulnerable being essentially a barge with low freeboard and a high top weight due to the elevated legs. Consequently they have relatively low stability in the towing mode.

Collapse of the sea bed under one or more legs of jack-up MODUs has resulted in accidents which have caused a high loss of life relative to the numbers on board. The situation has improved recently, with better techniques for investigating the sea bed and subsoil prior to location. Sea bed conditions are also important for anchored semi-submersibles or drillships. If an anchor fails to hold in bad weather, the unit may drift off station, possibly losing the drilling riser, although complete loss of the unit is unlikely.

Structural or stability failures of any MODU may be due to internal, external or operational influences.

Internal influences such as design faults, poor construction or inadequate equipment or fittings, are not readily amenable to operational cures. For a serious structural or stability failure the only action the crew can take is to save itself.

External influences - collision with a vessel, probably a supply boat, helicopter crashes and so on, are to some extent amenable to control by proper operational procedures, carried out by well trained crew members, either of the vessels (when associated with the unit) or aircraft, or of the MODU itself. Collisions with icebergs or pack ice may be averted, or the probability be lessened, by proper ice watch and by pre-arranged towing procedures carried out by dedicated vessels.

Operational hazards, caused by the mis-use of equipment, such as mooring and ballasting systems or jacking equipment, are the most

amenable to minimization by proper training. Incidents may be caused by an operator error, either when performing a primary operation or when correcting a fault, for instance counter flooding to correct trim.

Other lesser hazards involving marine operations and concerned with items of on board equipment are more likely to cause personal injury than to hazard the unit. However, some accidents, for instance when a heavy load is dropped, may cause loss of stability or buoyancy, if one or more compartments are holed by the falling load, or if major strength members are severed. Table 4.1 sets out a list of more likely hazards.

TABLE 4.1 - HAZARDS TO MODUs

Event	Cause
Hazardous atmosphere	Well bore blow-out, H_2S escape.
Fire	Well bore or sea bed blow-out Machinery failure Electrical system fault Accommodation - domestic galley Welding or cutting Helicopter operation (crash or refuelling)
Structure failure	Vessel collision (supply boat or passing vessel) Iceberg collision Pack ice Design or construction fault Lack of maintenance Sea bed failure
Loss of buoyancy or stability	Vessel collision Iceberg collision Pack ice Design or construction fault Ballast control operator error Loss of power
Accident while jacking	Jack failure Power system failure Jacking operator error Sea bed failure

4.2 MODU Crew Structure

Categories of Crew

The crew of a MODU may change considerably as the unit's activity changes. Three major activities are identifiable - operating on location, moving onto or off location, and transit between locations. The crew complement for each activity depends on the type of unit, the operating policy of the unit's owner and the country of ownership (flag of registry for MODUs registered as vessels). Other factors which may affect crewing include the nation exercising jurisdiction over the drilling area (the coastal state), and the lease operator who charters the unit.

In describing the crew of a MODU, it is useful to divide them by functions. For the purpose of this report, a simplified division adopted from the many different approaches is used.

The Marine Crew is considered to include all of those whose functions relate primarily to the MODU as a platform, either floating or standing on bottom. As well as watchstanders, ballast-control operators and the engineers, maintenance staff crane drivers and roustabouts are included.

The Industrial Crew refers to all those whose primary job is concerned with the well and the drilling rig. The actual drilling crew, well-testing personnel, casing crews and lease operators' representatives are included.

The Domestic Crew are the personnel who attend to the welfare of the others - the medic, the catering crew, stewards, laundrymen etc.

Marine Crew

Operators of jack-up units tend to consider all on board, to be industry personnel except for the special crews for jacking. In this report, they have been described under the same categories as for submersibles and drillships.

Most of the variations between types of MODU affect the marine crew. The drilling crew and its support personnel are virtually independent in this respect. The size of the domestic crew depends on the number of others to be catered for. Manning of all crews may be changed by activity; for instance, during jacking operations non-essential crew members may be taken off.

Drillships: These are invariably registered as ships. The marine crew is thus regulated by the flag state. Through IMO there is increasing uniformity in the national requirements for deck and engine room crews of ships.

Deck operations are conducted by Master, First and Second Mates, Radio Operators, Crane Operators (who frequently act as Roustabout Foremen), and Seamen/Roustabouts. Dynamically positioned ships also carry DP Operators who have equivalent standing to the mates, but these are not required by Regulation.

The engine department comprises Chief Engineer, Second Engineer, Motorman, Mechanics and Electricians. This is a larger department than on most conventional merchant vessels due to the additional drilling machinery and electrical and electronic systems, particularly in connection with dynamic positioning. The crew may therefore include electronic technicians, welders and other specialists not found on a merchant ship. Figure 4.1 shows the manning of a typical Norwegian dynamically positioned drillship.

The members of the crew are usually identified by the same titles as a ship's crew, although they may have additional jobs. The marine crew does not usually change between activities, and is fairly uniform between countries, owners and operators.

Semi-submersibles: In terms of marine crew, these are the units that exhibit the greatest variations in manning. One of the major causes of variability is that views differ between countries as to whether semi-submersibles are barges or vessels.

There are however also considerable variations between company practices and modes of activity. The following breakdown is based on country of ownership:

<u>Canada:</u>

There are two Canadian owned semi-submersibles in operation, and in the near future this is likely to increase. The two working are registered as Canadian vessels. The marine crew comprises a Master, First Mate, two Ballast Control Operators, Crane Operators, Roustabouts, Radio Operators, Chief and Second Engineers, Mechanic, Electrician and Motorman. The marine crew does not change between operational modes.

<u>United Kingdom, British Registered:</u>

The Department of Transport requires MODUs to be manned within the constraints of the various Merchant Shipping Acts. The following scales are minimum requirements for self-propelled semi-submersibles. Where additional manpower is required for marine tasks, such as attendance on tugs during moving or positioning, the drilling contractors' staff may be used:

a) Ocean passages, in excess of 24 hours:

Master	3 Engineers
3 Mates	3 Greaser/Wipers
Radio Officer	3 Catering Staff
Bosun	
3 ABs	

b) Well shift, ie a change of location accomplished in less than 24 hours:

Master	2 Engineers
Mate	1 Greaser/Wiper
Radio Officer	
Bosun	
2 ABs	

c) Drilling Operations

Master	2 Engineers
Bosun	1 Greaser/Wiper
2 ABs	

The Master and Chief Engineer must be British.

United Kingdom, Coastal State Requirement:

The Department of Energy Requirements for personnel on MODU working on the UK continental shelf are contained in the Mineral Workings (Offshore Installations) Act 1971 and in its subsidiary regulations. The requirements are:

An Installation Manager (person in charge or 'Master')

A person to act in his place (a 'Mate') in the event of him being sick or unavoidably absent

A Medically Trained Person (Rig Medic)

A Radiotelegraphy Operator

Persons to be in charge of:

The structure
Electrical equipment
Mechanical equipment
Lifting appliances and gear
Drilling operations
Handling and storage of dangerous substances
Any other unusual or dangerous operations

Responsibilities for the structure, electrical and mechanical equipment are usually assumed by a person with the status of chief engineer.

Norway:

The manning requirements for Norwegian registered semi-submersibles are laid down in Regulations covering the manning of Norwegian drilling units and other mobile off-shore installations. The regulations were issued on 23 March 1982 by the Norwegian Maritime Directorate (NMD) and entered into force on 30 April 1982. The required complement is shown in figure 4.2, together with a command structure which must be used. The minimum complement for moving is indicated, as well as that required while operating on location. The marine crew would not normally change for moves.

United States:

The US has the most possible variety in marine crews for semi-submersibles. Figure 4.3 shows the Coast Guard requirements for US flag vessels, and their variation with the type of unit and the activity in hand. From the right hand column of the table it can be seen that many of the USCG manning requirements can be fulfilled by industrial personnel. The US also establishes a minimum requirement for certified lifeboatmen. About six would be required on a typical MODU. They may carry out any normal duties.

Figure 4.4 shows a generalized marine complement for a US operated semi-submersible. The Toolpusher is shown as being in overall command of the unit, as this is customary on station, but this could be varied according to company policy. Usually the Toolpusher is only in command on operational location, and is replaced by a mariner for moves, sometimes as a requirement of the Coast Guard.

Jack-up MODU: On location, jack-ups generally have no marine crew on board other than Crane Operators, Roustabouts, Radio Operators, a Maintenance Supervisor, Maintenance Personnel and Motormen, all of whom are assisting in the industrial activity. During a move, some of these will leave and specialist jacking or marine personnel will be put on board. The specialists may be

employees of the unit owner or specially hired for the move. Figure 4.5 shows the marine complements for different activity modes of US jack-ups. Again, the Toolpusher is shown as in command, as is generally the case. The manning requirements for Norwegian jack-ups are laid down by the Maritime Directorate, but on an individual basis. The Department of Transport takes the same line with British jack-ups.

Drilling crew:

A typical drilling crew is shown in table 4.6. Unlike the marine crew the drilling crew does not change much with the MODU type. The drilling personnel are divided into two crews, who work in twelve hour 'tours' or shifts, one under the control of the Toolpusher (who may also be the person in charge of the MODU) and one under the control of the Assistant Toolpusher or 'nightpusher'.

At various times specialist service company personnel such as well-loggers, cement crews and casing crews may be brought on board for specific tasks. These personnel, being transient, rarely have a safety responsibility other than to perform their job safely.

Unless members of the drilling crew are assigned marine crew positions (common on US registered units - see figure 4.3), they will not usually remain on board during moving. Should non-assigned industrial crew remain on board they would basically be passengers, so far as the navigation of the unit is concerned, although they could be engaged in the maintenance of their own equipment.

Domestic crew:

Looking after the personal needs of the marine and drilling crews is a vital task, but one which does not bear directly on the substance of this report. Domestic crews include cooks, helpers, stewards, and the 'Rig Medic' or trained first aider. The

Centre for Remote and Offshore Medicine at the Memorial University of Newfoundland. The domestic crew, unless assigned special tasks such as lifeboatman, or firefighter, have only the need to act for their own safety in an emergency.

Requirements of the Lease Operator

The lease operator may impose additional contractual requirements over and above the flag state manning, although these usually concern either his own operational convenience or are limited to ensuring compliance with coastal state regulations.

RESPONSIBILITIES AND DUITES OF MARINE CREW MEMBERS

Person in Charge (Master, Offshore Installation Manager)

All administrations require one person to be ultimately responsible for the safety of a MODU of their own registry and the safety, health and welfare of persons on board. Some coastal states make requirements for a person to be in charge of any MODU working on their continental shelf, regardless of registry or ownership. There is no consensus on who is best qualified to be in final command: the senior drilling person or the senior mariner and what extra training they should have over and above their drilling or marine training.

Many of the duties of the person in charge are of necessity delegated to other persons as is normal in any industry. However, the person in charge must be familiar with all modes and functions of all the departments on the MODU so as to make intelligent decisions.

The person in charge has many responsibilities during normal operations. Much of his effort must be concerned with avoidance of hazards, but he must always be prepared for the unexpected. At all times he must:

- Maintain awareness of the status of all aspects of the unit and implications for the unit's safety. Of particular importance is the status of drilling operations in regard to the time necessary to hang off or disconnect.

- Maintain awareness of weather, sea state and sea ice forecasts and local conditions. If they are deteriorating, he must ensure that appropriate actions are taken in good time to prepare the unit.

- Maintain awareness of the marine aspects of the vessel, especially draught (or clearance), stability, anchoring and positioning, and trim, and see that accurate records of load changes are kept and used to calculate unit stability or leg loads.

- Ensure that all safety drills are carried out, and that personnel respond correctly and efficiently and can operate emergency equipment.

- Ensure that all emergency equipment is maintained in an operational state.

- Ensure that supervisors and crew are using safe working practices.

- Maintain awareness of the disposition of standby/rescue and other support vessels and aircraft, with particular attention to limitations on them, such as weather conditions preventing helicopter operations.

- Ensure that repairs or modifications are carried out as necessary and in a manner which does not affect the unit's safety.

At the time of moving the MODU, he must:

- Ensure that the vessel is prepared for the move, in terms of seaworthiness, crewing, supplies, communications and other matters.

- On jack-up MODUs, ensure that jacking is carried out safely.

- Ensure that anchor recovery and placement are carried out with due regard to safety, both of the vessel and crew and the MODU.

- Ensure that an effective watch is established and maintained both 'on deck' and where appropriate in the engine room, as well as in the control room.

- Plan and execute the move in accordance with all rules and regulations. Particular attention must be paid to moving jack-ups due to their need to have suitable places at intervals en route where the unit can be elevated if weather conditions are forecast as unfavourable.

Virtually every emergency situation on a MODU, whether connected with drilling or marine matters, will very quickly involve the person in charge. Up to a hundred persons may be at sea in close quarters, together with heavy machinery, fuel, generators and engaged in drilling for oil or gas. Almost any incident has the potential to develop into a threat to the safety of personnel. The main task of the person in charge is to organize the crew and other facilities, decide what actions are needed, to assign persons to carry them out, and to monitor progress and evaluate further needs. Contingency plans and operations manuals give rules, procedures and guidance, but the person in charge must be able to assimilate the information available and apply the plans to the particular situation. This must often be done under stressful conditions, rapidly, yet with due regard for the consequences of actions and the risks involved.

First Mate (Barge Engineer, Stability Section Leader)

The term 'barge engineer' is a misnomer. In a paper to OTC, Johansen and Hammett (1974) clarified the matter. 'To a person with a marine background the term barge engineer would automatically lead one to want to assign him to an engineers licence: he is a 'mate' aboard rigs'. The job analysis for the US Coast Guard (USCG 1978) reinforced this view. For barge engineers, it states: 'All activities and responsibilities are marine or emergency related in nature or application ...'

The nature of this job varies somewhat according to who is the Person in Charge (see preceding section). For example, the Ocean Ranger carried no Mate while on location, but the Master's duties covered part of this function.

On location the master and first mate mostly work 12-hour shifts, the same as everybody else. A fairly frequent arrangement is that the master, while always on call in an emergency, works 0600-1800, and the first mate works 1800-0600. In this case the duties would be shared according to the shifts.

The First Mate is primarily responsible for ensuring that all marine aspects of the unit are in good condition and being operated correctly. Crane Operators, Roustabouts (Seamen or Deck Hands) and on semi-submersibles, the Control Room Operators, are normally under his supervision. The major areas with which he is concerned are summarized below. There are of course differences between drillships, semi-submersibles and jack-ups. Where significant, these are noted.

At all times, the Mate must:

- Check and ensure that all deck equipment anchoring systems, cranes, winches, lifeboats, rafts, other lifesaving appliances and fire fighting systems are functioning and in good order and that routine maintenance is carried out;

- Ensure logs and other records are kept properly;

- Supervise Ballast Control Operators or co-ordinate ballasting with engineering (semi-submersibles and drillships, according to system fitted) and calculate daily stability and deck load;

- Supervise crane operators and roustabouts in cargo and maintenance work;

- Ensure that unit is prepared for forecast weather, sea and ice conditions.

- Assist with special operations, particularly diving.

During unit moves, the Mate must additionally:

- Command a deck watch (including navigation and all other aspects if self propelled);

- Maintain security of towing cables (if towed);

- Supervise the deployment and recovery of anchors by support vessels;

- Assist Person in Charge in positioning over new wellsite (DP, anchors or jacking).

While a person in charge decides what strategies to employ during all emergencies except those directly related to the well, the Mate is usually in control of the marine crew's activities. Typically his responsibilities in various situations may be:

- Man Overboard - prepares rescue equipment or boat for deployment, supervises launching and recovery.

- Fire - supervises fire fighting and rescue teams at scene of fire and keeps watch for safety of team members.

- Collision or Structural Damage - establishes extent of damage and initiates control procedures (watertight doors, compartment isolation etc).

- Abandonment - ensures final check and accounting of personnel; supervises preparation of survival craft; takes command of a survival craft on embarkation.

Watchstander (Ballast Control Operator, Control Room Operator, Watchkeeper)

MODUs, particularly semi-submersibles, require two types of watch to be kept. The first is a watch in the normal marine sense - supervision of deck and cargo operations, a lookout for other vessels, aircraft, radio traffic and fire alarms. The other is a watch on the stability, trim and draught, and their control through ballast changes and anchor tension adjustments. Particularly while drilling, this second watch is much more crucial than the equivalent on regular ships, since deck and bulk loads are continually changing, and the anchoring system is much more complex.

There are numerous solutions to the problem of keeping these watches. The only generalization that can be made is that the persons responsible report to the senior marine person on duty, whether or not he is the person in charge.

In order to define their duties, the person in charge of the marine watch is referred to as the Watchkeeper; the person in charge of stability, trim and draught, the Ballast Control Operator.

In summary, the duties of the Ballast Control Operator are:

- To maintain the stability and draught required by Master or Toolpusher by adjusting ballast and/or anchor tension to account for varying loads, load disposition and weather conditions.

- To monitor the integrity of the anchoring system, the tensions on the anchor chains and the operation of thrusters, and to alert the appropriate personnel if necessary.

- To predict the effects of supply operations on stability, trim and draught and adjust accordingly, and to notify appropriate personnel of required disposition of loads.

- To monitor the working condition of the entire ballast control, tank level metering and anchor tension control systems.

- To be prepared to counter any malfunction of the ballast control system or damage to hull structure.

- To maintain records of stability, bulk loads, deck loads and control room log.

The duties of the Watchkeeper are:

- To co-ordinate and assist the Barge Engineer in supervising the supply operations - vessels, cranes, cargo movements.

- To observe the weather and forecasts, and ensure that appropriate actions are taken when adverse conditions are expected.

- To keep a radar (if fitted), radio (if radio operator off duty) and visual watch for marine traffic.

- To assist the Barge Engineer in inspecting the hulls and structure of the MODU and ensuring that necessary repairs are carried out.

- To inspect lifesaving and firefighting equipment to ensure it is maintained and prepared for use.

- To maintain the deck logs.

- To co-ordinate helicopter movements.

- To keep a fire/fire alarm watch.

- To be prepared to supervise and participate in fire teams, man overboard rescue and rescue of personnel trapped by fire.

Chief Engineer (Technical Section Leader; Rig Mechanic; Rig Maintenance Supervisor; Rig Maintenance Superintendant)

The Chief Engineer is responsible for the propulsion system and all mechanical and electrical services. He invariably reports directly to the Person in Charge.

On some units, which are not registered as ships, his duties are split between a Mechanic and an Electrician with one designated in charge (USCG 1978).

The Chief Engineer oversees the maintenance staff and assigns duties, and is responsible for the operation and maintenance of all engineering and related machinery and equipment. He ensures that the appropriate records are maintained and that the areas under his jurisdiction remain a safe working place.

On drillships not fitted with bridge control of the ballast system the engineering department carries out the actual ballasting operations on the instructions of the Mate.

Radio Operator

Units off Canada's east coast generally carry VHF marine radiotelephone, marine single sideband radiotelephone, VHF airband radiotelephone, telex and satellite transmission equipment. Other possibilities include tropospheric scatter telemetry systems. When the unit is classed as a ship, most nations'

marine regulations require a marine radiotelegraph system, with a certified Radio Operator. However, through commercial necessity, most MODUs are equipped with communication equipment, far beyond the requirements of regulations, and the Operator must be able to use this equipment.

The Radio Operator's main role is to use the available equipment to transmit and receive information between the MODU and other stations: support vessels, aircraft, shore and other units. The traffic is almost all voice (radiotelephone) or teletype. Morse code is not used in regular procedures. He must also distribute received messages to the MODU personnel.

The Radio Operator is normally responsible for ensuring that the equipment is maintained in good working condition, that it is tested regularly and tests logged, for keeping the radio log, for ensuring that the radio systems are used in accordance with regulations and procedures, and that auxiliary power supplies are in good working condition. In addition, he may be charged with checking and maintaining radios in lifeboats, and hand-held VHF sets used on the unit.

The role of Radio Operator may be combined with others, most often the job of helicopter landing officer (HLO), since it involves communicating with the helicopter pilots. Another combination is radio operator/medic/HLO. This multiple combination would appear to be particularly onerous. These other jobs are discussed separately.

The Radio Operator is a key figure in emergency situations. Communication for assistance is vital, and knowing the correct person to contact and the correct procedures can save valuable time.

On many units, some of the radio equipment is commonly used by others than the Radio Operator, for instance by the Master, Tool-pusher or Operator's Representative. Modern technology has made the operation of radiotelephones very simple, but it is still necessary to exercise discipline.

Crane Operator

The Crane Operator is in a position to jeopardize safety in several ways. Cargo operations between a floating platform and supply boat in open water require a high degree of skill. There is no room for error, either in the operation of the crane, or in securing the loads, for which on the MODU the Crane Operator is also responsible.

Many Crane Operators begin their careers ashore. The job functions offshore are closely related, however, there are some additional special considerations.

Typical activities and responsibilities of a crane operator, adapted from Function Job Analysis of Mobile Offshore Drilling Unit Operations (USCG 1978) include:

- Operates crane to move materials, equipment and personnel to or from support vessels and moves heavy loads about the MODU.

- Responsible for training and supervising roustabouts in sling selection, sling maintenance, wire rope maintenance and care, securing a load, loading and offloading procedures etc.

- Responsible for the material condition of all cranes.

Other duties of the Crane Operator include keeping daily records of the crane operations, repairs and maintenance. Crane operations are halted when helicopters are in the vicinity of the unit and on some MODUs the Crane Operator is assigned to be in charge of the helideck crew (fire guards and refuellers).

Helicopter Landing Officer (HLO)

On many MODUs the HLO's job is combined with others such as Medic, Radio Operator or Safety and Training Officer, and consequently may be referred to by one of those titles. The term

HLO is British, as this job is one of the few required by regulation on offshore installations in the UK North Sea (Statutory Instrument 1976 No 1019). Nevertheless, the duties must be performed on all MODUs which are serviced by helicopter.

An HLO is the person responsible for controlling helicopter operations in relation to the MODU. As such, the HLO:

- Establishes communications with the helicopter (directly or via the Radio Operator) to check flight progress, ETA, report weather and relay other information.
- Ensures helicopter deck is cleared, cranes are stowed and that standby vessel is alerted.
- Ensures emergency equipment is in place and manned.
- Ensures sufficient fuel is on hand for refuelling and refuelling team is prepared.
- Carries out necessary procedures for the transfer of personnel and equipment (including manifesting) and ensures that refuelling is carried out safely.
- Carries out and participates in various emergency drills related to helicopter operations.
- Checks and reports any shortages or repairs necessary to equipment.

The HLO is <u>not</u> the person standing by ready to act in the event of a crash or fire. That person is usually designated as heli-guard or helideck firefighter.

<u>Dynamic Positioning System Operator</u>

All the drillships which have operated off Labrador in recent years have been dynamically positioned. In addition, SEDCO operates two DP semi-submersibles off Eastern Canada.

The DP console needs to be manned continuously, since although the positioning is computer controlled, a failure or partial failure could have catastrophic results during certain phases of drilling. The Operator must monitor the performance of the system, usually through automatic alarms, and be prepared to take suitable remedial action. This may include taking manual control should the computer or its sensors fail entirely.

Ice and Weather Observers

COGLA Regulations, Section 31 require the Operator to measure and record environmental conditions, to transmit them to shore, and to establish mechanisms for obtaining weather and ice forecasts aboard each drilling unit. These operations are done off Eastern Canada by contracted Observers. Until very recently there were two local companies performing this service, but others are now involved.

Off Nova Scotia, and the Grand Banks in summer, their duties have been concerned with weather only. Off Labrador, and the Grand Banks in winter, combined Ice and Weather Observers are stationed aboard MODUs.

There are two Observers on each MODU, working twelve-hour alternate shifts. The Observer is responsible for ensuring that meteorological and oceanographic monitoring equipment is properly maintained. He is responsible for taking readings from the equipment at regular intervals, usually every three hours, or more frequently when conditions or activities require it.

This information is relayed to shore, either directly by the Observer or by the unit radio operator. The Observer has no formal responsibility for incoming weather forecasts, but may be requested to help in interpretation. Lastly, the Observer is responsible for reading local conditions with respect to helicopter arrivals and departures.

When icebergs may be expected, the Observer has responsibility for monitoring icebergs in the vicinity of the unit. Mostly this is done by radar, but observation by support vessels and aircraft are taken into account. The Observer's duties include monitoring bergs (and pack ice) as they come within certain ranges, predicting their closest point of approach (CPA) and time to CPA. At all times he is responsible for keeping the person in charge informed.

If a large iceberg is predicted to drift too close to the unit, the Observer is responsible for recommending towing attempts. He will request the iceberg standby vessel to establish a tow and designate the tow direction. He will then continue to monitor and predict the iceberg trajectory and keep the unit personnel appraised. Iceberg drift trajectory prediction is now done by microcomputers using programs developed by the Observer companies. Observers must be able to input data, run programs and interpret output.

RESPONSIBILITIES AND DUTIES OF INDUSTRIAL CREW MEMBERS

Toolpusher

Historically, the Toolpusher has been the lead man on any drilling job, and the role has been continued as the offshore industry developed. However, depending on the type of drilling unit, the operating mode at any particular time and various company policies, the Toolpusher may or may not be the person in charge, although he is usually fully cognizant of all aspects of the MODU operation.

The Toolpusher is responsible for compliance with the drilling program, the proper conduct of drilling operations, the correct operation and maintenance of drilling equipment, compliance with government regulations and liaison with the onboard Operator's Representative. On floating MODUs he is responsible for the installation and maintenance of the riser and subsea blowout prevention systems (assigned by a specialist Subsea Engineer). The Toolpusher will have wider managerial responsibilities for the conduct of operators in a marine environment. He must:

- Ensure adequate logistic support for industrial activity either by surface or air.

- Assign duties to industrial personnel and ensure adequate personnel with proper experience are available on board.

- Be responsible for safety training and overall safety record of the industrial aspect of the unit and see that the safety program is carried out satisfactorily, including both operational (eg BOP drills) and occupational safety for individual workers.

- Be responsible for implementing company on-the-job training programs both safety and job related for industrial crew.

- Be responsible for the performance of industrial service personnel on board such as casing crew or cementers, and any specialists called in for short periods of time.

- In addition he is the first-line supervisor for industrial personnel administration and may be authorised to hire, promote, demote or terminate.

In emergency situations, he is responsible for:

- Taking the initiative to combat any well-related emergency such as the threat of blowout.

- Directing the preparations necessary to ensure the integrity of the drilling rig and the well bore in the event of forecast heavy weather.

- On the East Coast of Canada he must be fully aware of any impending pack ice or icebergs and the implications for the well activity. Such awareness would also include the formation of ice on the drilling unit itself which may affect the total loading or load distribution of the unit.

All of the above are duties and responsibilities of the Toolpusher relative to the operation of the unit in a drilling mode.

Offshore drilling rigs normally have a Senior Toolpusher and a Junior Toolpusher, usually known as the Day Pusher and Night Pusher, who work shifts. Their duties are similar but where a final decision must be made the Senior Toolpusher exercises his authority.

Driller

The Driller is responsible to the Toolpusher for the day to day drilling of the well.

In an emergency the Driller has immediate responsibility to control a kick, or threatened blowout. He is responsible for securing the well and drilling equipment for impending heavy weather and the necessary actions on the drill floor to prepare for change from drilling to survival mode.

His main responsibilities are:

- To guide and direct activities of the drilling crew on the drill floor and to operate the controls of the rig to perform various drilling functions.

- To help train the drilling crew in safe performance of their duties.

- To direct the handling of drilling equipment.

- To maintain drilling records.

- To make recommendations for personnel hires, transfers, promotions, discipline and discharges.

Subsea Engineer

Subsea Engineers are only employed on drillships and semi-submersibles where the BOP stack is installed on the seabed. The primary responsibility of the Subsea Engineer is for the blowout prevention control equipment and the riser tensioning systems on the rig. In addition he is responsible for the riser system, the latching systems on the BOP stack and in most cases the subsea closed-circuit TV.

Rig Safety Man

The duties of the Rig Safety Man are often undertaken by the Medic. They include:

- Making inspections and consulting with employees on unsafe working habits.

- Conducting safety training and safety meetings.

- Maintaining safety records and writing reports.

- The first-aid training of drilling rig crews.

Training for these duties is usually carried out in-house, both onshore and offshore.

Operator's Representative

The Operator's Representative is on board to ensure that the drilling program specified by the oil company is carried out by the contractor. His emergency response duties are in respect only of the integrity and the safe completion of the well. This includes such things as a potential kick or blowout; service operations relative to completion of the well - casing, cementing, testing; and the use of any special tools which may pose a hazard.

4.3 Marine And Safety Training For MODU Personnel

4.3.1 US Requirements

There are no statutory requirements for basic safety training. Most US companies do not consider that prior survival training is necessary for all persons working on a unit and in fact prefer on the job training and drills.

Marine Crew

The US Coastguard has requirements for the manning of US Registered MODU. Figure 4.3, taken from report No CG-D-76-78 of April 1978, summarizes the varying requirements for units under tow, under tow with propulsion assistance from the unit, under independent self propulsion, or on station. The requirements appear largely to be a semi-formal agreement between Coast Guard and owners. A proposal to amend Chapter 1 of Title 46, Code of Federal Regulations, governing the licensing of officers' and seamen's certificates for special purpose ships (including MODUs) has not been implemented.

Person in charge

Self-propelled units legally require a fully licensed Master, but only when on the move, although it is understood that it is customary for the Master of a drillship to remain in command when on station. For vessels under tow an unlicensed person may be in charge, and if the vessel has propulsion assistance, a Master with a 'special industrial licence'. For a unit moored on station the Master may be unlicensed.

Other Seamen and Engineers

A self-propelled unit requires a fully licensed mate for a long move of over 72 hours, otherwise units with propulsion require mates with special industrial licences only, and even then a towed unit with propulsion assistance can make a field move without a mate. All units require at least two able seamen as watchstanders and an ordinary seaman.

A self-propelled unit should have a chief engineer with a special industrial licence, and up to three assistant engineers. For a propulsion assisted tow, two engineers with special industrial licences will suffice, other units do not require licensed marine engineers.

REQUIREMENTS FOR QUALIFICATION :

Master and Mate

For unlimited Master or Mate licensing, the requirements are as for ships. The training and qualifications are to well understood standards, largely common to all countries and many schools offer courses in the academic aspects.

For the special industrial licences, the Coast Guard considers that certain 'industrial' workers have suitable experience and knowledge and can be additionally trained to serve for both their industrial job and for the marine role. Typically candidates for Master should have four years service on a drilling unit, two of them in a responsible position in the marine or drilling crew, or a Bachelor of Science degree and three years service, during one year of which he must perform supervisory duties. For a Mate, slightly less service is required.

In addition both Master and Mate are required to possess recent certificates obtained at approved radar training courses of at least five days duration, and must successfully complete a course of instruction at an approved well-control school.

Applicants for both licences must pass an examination, a candidate for Master being required to have more complete knowledge. When compared to those for standard marine certificates the examinations are not onerous.

The syllabus comprises the following subjects:

1. Rules of the Road, International and Inland.
2. Navigation Problems, not including celestial navigation.

3. Navigation, general, including practical chart navigation.
4. Ocean winds, weather and ice conditions.
5. Rules and Regulations for Vessel Inspection and Navigation Laws of the United States.
6. Units Business as it affects maritime transactions, and Sanitation.
7. Stability and mobile drilling unit construction.
8. Safety and Emergency Procedures.
9. Signalling (lifesaving, storm and special signals).
10. Pollution control and abatement procedures.
11. Industrial safety operations.
12. Such further examination of a non-mathematical character as the Officer in Charge, Marine Inspection, may consider necessary to establish the applicant's proficiency.

It is intended that in the future, there will be a requirement for a merchant mariner's document authorizing service as an able seaman (which includes lifeboat training) to be held during one of the years of service .

Engineers

The requirements for a candidate Chief Engineer are four years' service in operation, construction or maintenance of diesel engines, at least two of which should be as oiler, engineer, mechanic, electrician or similar on a suitable MODU. An Assistant Engineer requires two years' service as above, at least six months on a MODU. Other qualifications or marine engineering experience may abate the requirements. In addition both grades require a merchant mariner's document which includes the endorsement 'lifeboatman'.

Applicants for both licences must pass an examination in the following subjects - a candidate for licence as a Chief being required to have more complete knowledge:

1. Diesel engine construction and operation.
2. Internal engine lubrication.
3. Engine instruments, alarms and controls.

4. Fuel oil and fuel system.
5. Lube oil and lube oil purification.
6. Cooling, starting, intake, exhaust systems and drive trains peculiar to mobile offshore drilling units.
7. Engineering safety.
8. Handling of combustible and flammable liquids.
9. Portable water system.
10. Auxiliary boilers.
11. Miscellaneous systems.
12. Electricity (for chief engineer includes basic electronics).
13. Rules and regulations for vessel inspection.
14. Pollution control and abatement procedures.
15. Industrial safety operations applicable to engineers.
16. Such further examination of a non-mathematical character as the Officer in Charge, Marine Inspection, may consider necessary to establish the applicant's proficiency.

COURSES AVAILABLE

Special Industrial Licences

Courses are available in a number of schools, usually proprietary, to teach the requirements of the special licences/tests. One school which was consulted offers a 17 day course for either Master or Mate of MODU for US$ 1,200, or US$ 1,350 if combined with the 4 day Able Seaman/Lifeboatman course. The course is intensive, six days per week with classes from 8.00am to 5.00pm and in the evening from 6.00pm to 10.30pm. No assessment could be made of its merits, but a high examination success rate is claimed. Some major operators provide in house training programs. One operator has an arrangement with a private school and uses a four week program. At least one school outside the US is known to have offered a course which has successfully taught the special industrial licence requirements for Master. The 260 hour (seven week) Marine Operation Supervisors course at Aberdeen Technical College met the requirement.

Such short, intensive courses cannot go too deeply into the matters which are the concern of a ship master or chief engineer, but coupled with the requirements for service experience they are very suitable for most US conditions, particularly in areas such as the Gulf of Mexico. Although they are limited to persons operating MODUs under tow or on station, they may not be adequate for units operating in more onerous conditions, far from land.

Ballast Control Operator or Watchkeeper

There is no statutory requirement for training of ballast control operators, but at least one US school offers courses in ballast control using a simulator, and the industry is taking advantage of the opportunity. A five day course on basic stability and buoyancy three days of which are on the simulator is offered for US$ 1,200. The course may be taken in two modules. The course is 'US Coast Guard approved', but its exact official status is not clear. The IADC/PETEX program includes a self-instruction workbook. The level of stability theory is elementary and the test comprises 20 multiple choice questions.

Drilling Training

Blow-out: Persons engaged in drilling operations on the US Outer Continental Shelf must be trained in well control. For 'rotary helpers' or roughnecks, and derrickmen, the requirement is for hands-on drills at the job site, but for drillers, toolpushers and operators' representatives, a course of instruction lasting at least two, but more usually four, days and a test involving written and simulator work, with a 70% pass mark is required. The Coast Guard requires that candidates for special industrial Master and Mate must have successfully completed well control school. Specialist courses relating to subsea BOP are available.

Lifeboatmen

It is a requirement of the Coast Guard that for each lifeboat or liferaft there should be a number of certificated lifeboatmen to

a scale depending on the type of vessel. There appears to be no scale for MODU but about six to eight would be required by the Coast Guard certificate inspection for a typical MODU. The basic training of a lifeboatman lasts four to five days, and the syllabus apparently only covers open lifeboats. Again the Coast Guard requires Masters and Mates holding special industrial licences to have undertaken lifeboat training.

One company consulted considers the six to eight lifeboatmen to be adequate for a typical semi-submersible with 60 to 80 crew.

Fire Training

Although not a legal requirement, fire training is available at a number of schools. The Fire Protection Training Division, Texas A&M University, has a course which is approved by the Canadian Coast Guard as satisfying the requirement for Part B of Med II. RA Safety and Survival Inc, Katy, Texas provides a two day course including a breathing apparatus/smoke exercise. The course is held in conjunction with the Lamair University and the Beaumont Fire Department and is tailored to employers' requirements.

4.3.2 Norwegian Requirements

Basic Safety Training

A requirement for all MODU crew to be given basic safety training before employment offshore is given in 'Regulations concerning Qualification requirements for personnel on Norwegian drilling units and other Mobile Offshore Installations'. These regulations were issued by the Norwegian Maritime Directorate on 23 March 1982 and entered into force on 30 April 1982. A two-week course in basic safety training at an approved training centre is specified, supplemented by in-job safety training arranged by the owner/company during the first period of employment.

The Norwegian Petroleum Directorate now insists on safety training for all personnel, not only marine crew, regularly employed offshore, as a consequence of the Alexander Kielland disaster.

Technical Training

Certificates of competency are required for the following posts:

- Platform Manager
- Control Room Operator
- Stability Section Leader
- Engine Room Operator
- Technical Assistant
- Technical Section Leader
- Driller
- Drilling Section Leader
- Crane Operator

The courses which have certification requirements must be approved by the Norwegian Maritime Directorate.

Person in charge

The Platform Manager has highest authority on a MODU during drilling, moves and anchoring, conferred by the Regulations on Manning of 23 March 1983 (see section 4.2). To obtain a certificate of competence as a Platform Manager, he must hold a Master Mariner's certificate and have had one year's experience in a

senior position on a MODU. Alternatively, he may have training and experience equivalent to that of a Master Mariner, including examinations, plus two years on a MODU at a senior level. In addition, he must complete an approved course specifically for Platform Managers, and be a Norwegian citizen.

He has a statutory duty to consult the Drilling Section Leader and the Stability Section Leader in any circumstances which endanger the drilling installations. His safety responsibilities also include arranging lifesaving drills and safety drills; and ensuring that fire-fighting and life-saving equipment complies with regulations, and for ensuring persons are trained in their use.

Mate (Stability Section Leader)

On semi-submersibles, the mate is called the Hull and Stability Section Leader. He is directly responsible to the Master, and must supervise safety training in his area of responsibility. In order to obtain a Certificate of Competency as a Hull and Stability Section Leader, a person must hold a Class 2 Marine Certificate (Mate or Engineer), have had at least a year's experience as a Control Room Operator (see Watchstander) and pass an approved course. He is ultimately responsible for stability and ballasting and the control of structural loads.

Watchstander (Control Room Operator)

The Control Room Operator is the Norwegian equivalent of a Ballast Control Operator in the US. He is responsible for carrying out ballasting and stability operations, with the help of a Control Room Assistant. He also monitors the position of stand-by vessels and helicopters.

Two persons on watch are required per shift. A Control Room Operator must pass a course and have marine qualifications (deck or engine). Alternatively he must spend two years at technical college and have one year's experience as Control Room Assistant

or Engineer. He must be supported by a Control Room Assistant, who must pass an examination on top of a marine qualification or alternatively have undertaken two years' specialist training.

Safety Officer

The Safety Officer works directly to the Platform Manager and must inform him of significant matters. He is responsible for safety training on board and must organize the life-saving and fire service, lead and take part in practice drills, and instruct newcomers in safety routines and escape routes. He should be qualified as follows:

1. Education and training in safety measures and operations,
2. Experience equivalent to a control room or engine room operator,
3. Two years service on a drilling unit,
4. An approved course on safety and the working environment.

Radio Officer

According to the Manning Regulations, the Radio Officer is responsible to the platform manager for keeping watch in the radio room and for compliance of equipment and its operation with the requirements of the Norwegian Telecommunications Administration (NTA). Under the regulations concerning qualification requirements, he is given the additional duty of controlling helicopter movements to and from the rig and must be given training for this role. He requires a valid Radio Telegraphy Certificate issued by the NTA.

Engineering and Technical Personnel

Technical Section Leader

The Technical Section Leader is responsible for the operation, maintenance and repair of all mechanical and electrical equipment on board, including cranes. He has to monitor the qualification

and safety training of his staff, and supervise systematic maintenance. He would be certificated, which entails an approved course of training, a certificate as Marine Engineer Officer Class I or Chief Engineer, and at least one year as a technical assistant.

Technical Assistant

His duty is to assist the Technical Section Leader, particularly in respect of repair and maintenance of the drilling unit, and similarly to assist the chief electrician. For certification, he requires special training in the mechanical, hydraulic, pneumatic and electrical equipment used on MODUs, at least one year's practice as an engine room operator or engineer, and a Marine Engineer Officer (Class 2) certificate or a First Class Engineer's certificate.

Electricians

Electricians Grades I and II form part of the statutory crew of semi-submersibles. Both require the Certificates of Marine Electro-automation Officer, Electrician II must receive appropriate training from the company, while Electrician I must have one year's experience, and also be approved by the Maritime Directorate if handling an operating voltage greater than 1000v.

Drilling Personnel

Norway has a progressive training requirement for all drilling crew. It was designed to build up a national drilling capability as there has been little, if any, onshore drilling. The training is heavily orientated towards the offshore and although many aspects are common to onshore drilling, the scheme is important enough to warrant consideration.

Drilling Section Leader (Toolpusher)

The Drilling Section Leader is responsible for the safety aspects of all drilling operations, including the qualifications and experience of personnel, the safe conduct of drilling procedures and proper maintenance and use of equipment. He is also responsible for general safety training of all his personnel and for blowout preventive training. He must inform the platform manager of all significant matters.

Some of these obligations are shared by his subordinate, the Driller, as laid down in Manning Regulations 1982. The Driller takes care of safe working conditions on the drill floor and compliance with current safety regulations.

Certification is obtainable at the levels of Drilling Section Leader and Driller, although the regulations concerning qualification requirements also recognize the grades of derrickman, assistant derrickman, assistant driller, assistant drilling section leader, subsea engineer and drill floor crew (roughneck).

There are two main routes through drilling qualifications. One is to spend one or two years at a technical training college offering courses in drilling technology, followed by experience on the drill floor and a short course at the level of assistant drilling section leader and drilling section leader. The second is more concentrated on work experience supplemented with short courses (Drilling Courses I and II). These requirements are summarised in Table 4.2, but the regulations also allow the Ministries to approve foreign training or accept less qualified personnel for short periods when suitably qualified persons are not available.

TABLE 4.2 TRAINING STRUCTURE FOR DRILLING CREW (NORWAY)

Grade	Experience on Continental Shelf	Education
Drill floorman	Six months as drilling assistant or other	Three week drill floor man (Drilling Course I)
	or	
	Ten weeks	One year technical school in drilling technology
Assistant derrick man	Six months as drill floor man	Four week derrick man (Drilling Course I)
	or	
	Three months as drill floor man	One year at technical technical school
Derrick man	Six months as assistant derrick man	-
	or	
	One year as drill floor man	Four week derrick man course (Drilling Course I)
	or	
	Six months as either of the above	One year at technical school
Assistant driller	One year as derrick man	13 weeks assistant driller (Drilling Course II)
	or	
	One year, including six months as derrick man	Two years at technical school
Driller (certification required)	One year as qualified assistant driller (route 1)	Three weeks driller course
	or	
	Two years as derrick man	13 week assistant driller plus three week driller course (II)
	or	
	Two years including 1½ years as derrick man (assistant driller)	Two years at technical school

Grade	Experience on Continental Shelf	Education
Assistant drilling	One year as driller	Subsequent 18 week course for drilling section leader
	or	
	Three years including at least one as driller or one as assistant driller	Two years technical school plus 18 week course for drilling section leader
Drilling section leader (certificated)	One year as assistant drilling section leader by route 1	-
	or	
	Two years as driller	Subsequent 18 week course for drilling section leader
	or	
	Four years including at least two as driller or one as driller and one as assistant drilling section leader	Two years technical school plus 18 week course for drilling section leader
The short courses have to be taken at an approved or recognized school		

Crane Operator

As well as being responsible for the operation and maintenance of cranes, the crane operator must supervise the maintenance workers where this task has not been assigned to a worker's manager or other member of the crew. He must be at least twenty years old. A Certificate of Competency, Crane Operator exists. The Regulations concerning qualification requirements say he must have completed the training necessary in accordance with the Regulations issued by NMD. NMD's certification regulations, however, merely require approved theoretical and practical training.

Other

Duties are also laid down for the Catering Section Leader, Cook, galley crew, welder, medical warden and worker's manager.

COURSES AVAILABLE

The Certification and Qualification Regulations of 1981 and 1982 impose a burden of approved courses although many of them, particularly for maintenance training, are already well established. The education authorities are the Ministry of Church and Education (primary and secondary education) and the Ministry of Cultural and Scientific Affairs (higher education). The Maritime Directorate is responsible for the certification of seafarers, and will therefore approve all courses mentioned in the previous section, except those related to drilling and machinery.

Drilling companies tend to have their own training programs for commercial reasons, as well as to comply with the Work Environment Act.

Safety Training

The course details of basic safety training are laid down in the Provisional Directives for Recognition of Basic Safety Training for Personnel who are to serve on board Norwegian drilling platforms and other mobile offshore units, issued on 13 June 1980, with immediate effect. They are known as LEIRO courses and were based on industry practice at the time, recommended by LEIRO committee II in 1978. The basic safety course has three parts.

Part I

A one week basic course covering the following:

- Introduction	2 periods
- Transport safety	2 periods
- Fire control	12 periods
- Damage control	10 periods
- Safety measures to prevent accidents	6 periods
- First aid	8 periods
TOTAL	40 periods

Part II

This part of the course is provided by the employing company and relates specifically to any special safety aspects of the installation where the trainee is employed. Its length should be suitable for the material and cover the following topics:

- Company philosophy and measures to prevent accidents
- Rescue, fire control and emergency equipment for the platforms
- Company personnel transport procedures
- Platform arrangement, systems and equipment.

Part III

This is an extension to Part I with special emphasis on fire and damage control, as follows:

- Fire control	10 periods
- Damage control	19 periods
- Laws and regulations	2 periods
TOTAL	40 periods

Appendices to the regulations give more details of the subjects to be included. Part I includes theory and drills for using portable fire fighting equipment. The major part of Part III consists of practical work with fixed fire fighting systems, in pools and on boat and helicopter pick-up systems.

The Norwegian Petroleum Directorate (NPD) has recommended that all regular personnel should take Parts I and II, and Part III should be required for all platforms where drilling or production were taking place. The NPD recommendations, however, apply only to fixed platforms.

Many maritime institutions offer LEIRO courses (see table 4.3).

The point was made by NIFO that offshore operators accept the principle of compulsory safety training but are concerned at the lack of training facilities. The training is required for fixed platforms as well as MODUs. Mobil Norway will have to train 1,800 people for the commissioning of the Statfjord B platform alone, thus stretching the facilities available.

A committee set up by the Government recommended that seven regional centres should be built for basic training, but no action was taken (November 1982 data).

NIFO decided itself that it needed a top-quality school to meet its own requirements as well as those of the regulations. Consequently it founded and financed the National Academy of Damage Control and Sea Rescue, built next to the site of the Haugesund Maritime School. The Academy was operational within a year and 25 M Nkr of operators' finance had been put into it by November 1982.

Platform managers' courses are offered at the Trondheim Maritime College. The course length has been reduced from ten to six weeks, with the requirement that the Stability Section Managers' course of 14 weeks has already been passed. The course covers drilling technology; oil industry economics and administration; safety tactics, organization and administration; law; and rig manoeuvering.

In setting up the course, there was much discussion on whether drilling technology should be included. This subject is now covered by the Stability Section Leader course which is now a required prequalification. The examinations on drilling, stability and anchor handling were found difficult by existing platform managers, who average 50 years of age.

By mid 1983, the platform managers' course had been taken by 139 people.

The only approved course for Control Room Operators began in the 1982/83 year at Haugesund Maritime High School.

The course duration is six weeks. The course content was developed with the assistance of the offshore operators. The various modules include mathematics, ballasting systems, stability theory, intact and damaged stability, damage control, positioning systems and the use of computer programs.

Details of offshore training courses which were collected during visits in 1982 are presented in Table 4.3. This list is not comprehensive, and does not include any courses which are specifically for maritime certification.

It is customary for courses at higher levels to be structured in one week modules, so that they can be taken during the 21 day onshore periods which alternate with the two week offshore duty period in Norway.

TABLE 4.3 OFFSHORE TRAINING INSTITUTIONS (NORWAY)

Name	Courses offered (weeks)	Facilities
Haugesund Maritime High School	Technical supervisor Stability supervisor (14) Technical assistant (5) DP operator Operation room controller (6) (in preparation - 1982)	 Model of Aker H3 Simulator for semi-subersible, DSV or 12,000 t tanker.
Haugesund Mekaniske Verksted A/S (Platform Constructor)	LEIRO I and III	Training pool with helicopter underwater escape mock-up. Firefighting ground.
National Sea Candidates School Bergen	LEIRO I and III Firefighting (2)	Pool Small fireground. Use rigs in Bergen shipyards for lifeboat training on occasion.
Trondheim Maritime School	Platform Managers course (stability course must be taken first) LEIRO I & III One week course in manoeuvering training taken by some platform manager trainees	Free fall lifeboat Free fall lifeboat drill Bridge/vessel simulator

Stavanger Maritime Engineering School	LEIRO I and III combined Three day first aid Five day fire leader Five day safety theory In preparation - fast rescue crew; emergency preparedness for platform management Derrickman Driller Tool pusher in broad-based or concentrated form Five day annual refresher courses for drilling personnel	Labyrinth for smoke test with breathing apparatus Training tank with helicopter underwater escape trainer and hoist in construction (1982) Simtran drilling simulator, mud tanks, model of Amoco platform
Bergen Engineering School	18 week driller course (1 week modules) 1 week annual refresher course, well control	
MENI (Mobil Exploration Norway Inc) Training Centre	LEIRO II, 1-1½ day for mobile units Four day supervisors' course	
Rogaland District High School	Three year courses in drilling Engineering, Reservoir Technology, Production Engineering et al. One year course on safety and maintenance One year course on safety and probability Graduate courses in association with its research institute	Digitron simulator for well control
National Academy of Damage Control and Sea Rescue	LEIRO I and III Fire team (5 day) Fire team refresher (2 day) Heliguard (2 day) Lifeboat cox (4 day) Tactical safety and fire control (5 day) Gas tanker safety (10 day) Stand by vessel crew (5 day) (in preparation 1982)	2 miles of shoreline. Large concrete fireground. Breathing apparatus structure. Use of pool at Haugesund Mek. Verksted A/S. Lifeboat platform. Helideck with mock up S61. Planned 1982: Training tank; Second helideck.

4.3.3 United Kingdom Requirements

Basic safety training

It is a requirement of the Department of Energy that all persons working on a MODU on the UK continental shelf shall have suitable training for their own safety, the safety of their workmates and the safety of the MODU. The requirements are stated in the Mineral Workings (Offshore Installations) Act 1971 and the Health and Safety at Work etc Act 1974. No standards are set for the basic training in these Acts and the UK Offshore Operators' Association, with the assistance of the Offshore Petroleum Industry Training Board (OPITB), has prepared guidelines to meet the requirements.

The 'Guidelines for Offshore Emergency Safety Training on Installations' of December 1980 set out training needs for six categories of person:

Category A	Casual visitors (eg Government Inspectors, VIPs, press and others)
Category B	Contractor/vendor personnel who work offshore occasionally
Category C	Company personnel who work offshore occasionally
Category D	Nonsupervisory contractor personnel (other than Category B)
Category E	Supervisory contractor personnel (other than Category B)
Category F	Permanent offshore company personnel.

The requirements are on an increasing scale, from a briefing of casual visitors on their emergency stations, recognition of alarm signals and the authority of the Offshore Installation Manager in an emergency; to proper training in emergency procedures for fire, abandonment, helicopter emergencies and specialized company procedures for permanent offshore company personnel.

In addition, the Guidelines give requirements for seven classes of person with specialist emergency duties:

Helicopter landing officers
Fire team
Fire team leaders
Helideck fire crews
Lifeboat coxswains
First aiders (other than the 'rig medic')
Supervisory persons

At present not all offshore workers are trained to the standards of the Guidelines, and the operators find it difficult to enforce them on contractors' MODUs. The Department of Energy monitors the situation.

In addition to the training, UKOOA has prepared 'Guidelines for Offshore Emergency Drills and Exercises on Installations'. These Guidelines set out the requirements for regular practice drills and musters as required under the Offshore Installations (Emergency Procedures) Regulations, SI 1976 No 1542, and for more extensive exercises. The Guidelines recommend:

<u>Musters</u> : Weekly - all personnel to attend and report to their emergency stations.

<u>Lifeboat drills</u> : Weekly - all personnel to attend and report to their lifeboat stations where lifeboat coxswain gives instruction on equipment and its use - eg engines, radios etc; every eight weeks all craft to be lowered over the water (weather permitting).

<u>Fire fighting</u> : Every twelve days - fire team to their stations for instructions or practice.

<u>Breathing apparatus</u> : Monthly - all who may have to use it attend for instruction or practice.

Emergency equipment : Monthly - All who may have to use it, for instruction and practice on specialist emergency equipment.

Casualty handling : Monthly - emergency teams and first aiders for instruction and practice with casualty handling equipment.

First aid : Monthly - qualified first aiders and other selected personnel for first aid instruction.

Man overboard : Every two weeks - all personnel on a random basis, involving the standby vessel.

In addition the Guidelines set out three types of major exercise to put into practice the lessons learned in drills:

Drill-proving exercises : Twice per year - under the control of the Installation Manager.

Major in house exercises : Once per year - involving onshore personnel.

Major exercises : At greater intervals - involving the regulatory authorities, police, Coastguard, military, press etc (these are co-ordinated by the Department of Energy, on a regular basis - only one exercise a year is held, but all operating companies either participate or observe).

On the basis of the industry Guidelines, the Department of Energy has not made additional requirements for training, drills or exercises, although it monitors the training and drills and co-operates in the exercises.

Person in charge

For British registered MODUs the Department of Transport requires a British Master. No requirement other than a mariner's certificate is laid down.

For a MODU working on the UK continental shelf, wherever it is registered, the Department of Energy requires an Offshore Installation Manager (OIM) under the Mineral Workings (Offshore Installations) Act. The responsibility for appointing a suitable person rests with the owner of the installation. Two or three day courses are available for OIMs, which concentrate on his statutory duties, his relations with the authorities and the police.

Marine crew

On British registered MODUs, the crewing requirements are as set out in 4.2. Again no specialized MODU training is required by law, although it is invariably company practice to provide oil-field training either by courses or work experience for the senior mariners.

Competent Persons

For MODUs of any registry working on the UK Continental Shelf, the Offshore Installations (Operational Safety, Health and Welfare) Regulations 1976 require the installation owner to appoint 'competent persons' to be responsible for the control and safety of:

- the structure of the installation;
- the electrical equipment of the installation;
- the mechanical equipment of the installation;
- lifting appliances and lifting gear;
- drilling operations;
- production operations;
- the handling and storage of acids, caustic alkalis, explosives, radioactive and other dangerous substances, and
- any other unusual or dangerous operation.

The duties in respect of the electrical, mechanical and lifting equipment are often assumed by the Chief Engineer or maintenance supervisor. No definition of competency or standard of training

is given in the Regulations. The Regulations ensure that the owner has assigned responsibilities, but it is up to the owner to determine the level of training needed to ensure competence.

Radiotelephone operator

MODUs on the UK continental shelf must have a Radiotelephone operator, with a certificate of competence issued under the Wireless Telegraphy Act 1949.

A specific duty is to relay information on meteorological conditions on the MODU to the captain of an approaching helicopter.

Helicopter landing officer

The helicopter landing officer is responsible for the control of helicopter operations in relation to the MODU. No formal training requirements are laid down, but he must have knowledge of deck procedures, transfer of personnel, the loading of cargo and refuelling as well as the operational needs for meteorological information. A two day course has been prepared with the co-operation of the helicopter companies, Civil Aviation Authority, UKOOA and the Department of Energy, which covers the necessary safety and working procedures.

Crane operator

No requirement is laid down for the training of crane operators, but several private crane companies conduct courses specific to offshore operation for crane operators and these are used by the industry.

Drilling crew

There are no statutory requirements for certification of the drilling crew which relate specifically to the offshore environ-

ment but the Offshore Installations (Well Control) Regulations SI 1980 No 1759 require the drilling supervisor (who may be the toolpusher or company representative) in overall charge of the drilling operation and the driller in immediate control, both to have obtained certificates of adequate knowledge of well control techniques including, in the case of the supervisor, those relating to the safe resumption of normal working. The certificates are issued by the Department of Energy, on the recommendation of the OPITB, which provides and marks test papers.

Courses

Few, if any, courses are 'approved' by the Department of Energy, although inspectors of the Department sometimes collaborate in setting them up and often attend as observers, lecturers or even trainees. The only statutory requirement is for certain key drilling personnel, who must obtain Department of Energy Certificates in well control.

Safety training

The OPITB publishes 'Training Courses to meet UKOOA Guidelines', which gives details of courses available at the Offshore Fire Training Centre (OFTC) Montrose, PETANS Lowestoft, SCOTA Aberdeen and RGIT Aberdeen, to meet the UKOOA requirements. The courses include:

Introduction to Offshore Survival	1 day
Basic survival for contractors (inc fire)	5 day
Combined basic survival, fire fighting and survival first aid	5 day
Basic survival	4 day
Survival refresher	2 day
Totally enclosed lifeboatman/coxswain	2 day
Helicopter passenger safety	1 day
Helicopter landing officer	2 day
Helicopter refuelling	2 day
First aid certificate	3 day
Basic offshore fire fighting	4 day
Helicopter course	2 day
Breathing apparatus	2 day

The OFTC also offers more advanced fire training courses than those required by UKOOA, including the training of complete MODU fire teams.

Person in charge (OIM)

SCOTA and PETANS both offer three day courses for OIMs. These concentrate on statutory duties and liaison between OIM and the Department of Energy and other authorities including the police. Department of Energy inspectors and the police lecture at these courses. Aberdeen Drilling Schools Limited offers a similar course of two days duration. None of the courses have official status, yet in the absence of statutory requirements they are widely accepted.

Crane operator

Several private crane companies conduct courses for Crane Operators on land and some will send instructors to train operators actually in the cab.

Sparrows Offshore Services trains offshore Crane Operators on an offshore type crane, with the pedestal located about 100 feet above water in a disused quarry, as well as having instructors to go offshore.

SCOTA has a course but it is primarily related to rigging and slinging (SCOTA 1983, personal communications). PETANS have for several years offered two types of offshore Crane Operators courses through the Construction Industry Training Board.

a) For persons with some offshore crane operating experience, a five day course.

b) For personnel with no crane operating experience, a two week course.

For the above SCOTA and PETANS courses, there are no facilities for practical crane training in an offshore environment. This is taught using videotape and verbal instruction.

Drilling crew

The OPITB, at its drilling training centre in Montrose, offers numerous courses in drilling at all levels, as does the commercial Aberdeen Drilling School. Both include courses to teach well control to the level of the Department of Energy well control certificate.

TABLE 4.4 OFFSHORE TRAINING INSTITUTIONS IN THE UK

INSTITUTION	COURSES OFFERED	FACILITIES
OPITB, Montrose OFTC	Firefighting - from 1 - 4 days Helicopter fire - 2 days Breathing apparatus	A fire module, simulating an offshore unit, fire grounds, helideck.
In 1982 some 3000 persons attended the various offshore fire courses		
OPITB, Montrose	Well control - 5 days	T32 drilling rig well control simulator
In 1982 some 1250 persons were certificated in well control		
SCOTA Aberdeen	Helicopter landing officer - 2 day Helicopter refuelling - 2 day First aid - 2 day Crane rigging - to order OIM duties - 3 days Stability for control room operators, semi-submersibles	Classrooms
PETANS Lowestoft and Norwich (in conjunction with Lowestoft College of Further Education	Helicopter escape - ½ day Helicopter landing officer - 2 days Basic survival - 4 days First aid - 3 days Crane operator days	Totally enclosed lifeboat, survival capsule, helicopter dunker, drilling simulator
Aberdeen Drilling Schools Ltd	Well control - 5 days OIM duties - 2 days	
Robert Gordon's Institute of Technology, Offshore Survival Centre	Offshore survival - 5 days Lifeboat coxswain - 2 days Helicopter escape - ½ day	Totally enclosed lifeboats, rescue craft, helicopter 'dunker'
Sparrows Offshore Services	Offshore crane operator 3 stages each 5 days Offshore slinger - 3 days Lifting gear examiner - 3 days	Various cranes, including elevated offshore crane, lifting over water

4.3.4. Canadian Requirements

Two separate authorities issue regulations governing oil and gas activity off the East coast of Canada. National regulations are issued by COGLA, the Canadian Oil and Gas Lands Administration, while provincial regulations are issued by NLPD, the Newfoundland and Labrador Petroleum Directorate.

Basic safety training

There is a requirement for basic safety training in the Canada Oil and Gas Drilling Regulations (PC 1979-25 amended by PC 1980-2111) published in November 1980. In part V Safety and Training of Personnel, section 150 requires all drill crew members to be familiar with the safety procedures they may be required to perform. Section 151 states that all persons employed at the site must be familiar with personal safety and evacuation procedures. It is the operator's responsibility to meet these requirements.

COGLA also issues guidelines and procedures for drilling operations, known as the 'red book'. In 1983 it amended the section on training to enlarge on safety and evacuation procedures for offshore rigs. From 1 November 1983 it will require every person employed offshore to have successfully completed an approved course which includes evacuation procedures, escape from a ditched helicopter and survival in cold water and extreme cold.

Regulation 149/82 of the Newfoundland and Labrador Petroleum Drilling Regulations 1982, makes similar provisions.

All persons employed in a drilling program must receive instruction and training for all operational and safety procedures they may be required to carry out. Permanent employees must have a marine emergency duties (MED) certificate or equivalent training. The regulations also stipulate that a fortnightly fire drill and weekly abandon ship drill be held with all personnel wearing lifejackets. BOP practice drills must also be held weekly during drilling operations, and all personnel must be

familiar with personal safety and evacuation procedures connected with the drilling operation. These regulations are not policed - the onus is on the employer.

The East Coast Petroleum Operators Association, together with the Arctic Petroleum Operators Association, set up a task force to examine safety practices. In its draft report of 15 April 1983, it made recommendations on Basic Offshore Training. As a result, the Basic Offshore Training (BOT) course has been accepted for offshore personnel in Nova Scotia.

Newfoundland and Labrador has its own rig specific Basic Offshore Survival Training (BOST) course. It was developed by a committee representing the Education and Training section of OPIC (the Offshore Petroleum Impact Committee); the College of Fisheries, Navigation, Marine Engineering and Electronics; the NLPD and the safety branch of the Provincial Department of Labour and Manpower. Details of BOT and BOST courses are given in the section on courses.

Person in charge

Operators must, in their contingency plans and operational manuals, name the person in charge of a MODU (COGLA requirement).

Since Canadian flag MODUs are all currently registered as vessels, the person in charge is the Master, who must hold a Master Mariner's certificate. The visit report with EPOA suggests that non-Canadian drilling companies can choose whether the person in charge of a rig is qualified as a Toolpusher or a Master, which may depend on the flag of the vessel. There is however no requirement for any training in drilling operations.

From September 1983, persons applying for new senior marine certificates (ON2, CN2 and Second Class Engineer) will be required by the Canadian Ministry of Transport, to attend a 5 day MED III (Advanced MED) in which the emphasis will be on leadership in various emergencies.

Ballast control operators

Before February 1982, there were no government requirements for training or certification. The Provincial Minister of Mines and Energy issued a statement on winter drilling on 5 November 1982 requiring a training program for drilling personnel on barge/ballast control. In the spring of 1983 the NLPD directed Operators (oil companies) to ensure that ballast control operators attend a course on stability. This only applies to units operating off Newfoundland and Labrador. From November 1983, appropriate marine personnel will have to have completed an approved course of studies in ballast control for floating units (COGLA red book, 1983).

Weather and ice observers

Section 31 of the Canada Oil and Gas Drilling Regulations 1980 requires offshore operators to obtain meteorological and ice movement forecasts at least daily and to equip drill units with facilities for recording their own measurements and observations.

Industrial Crew

The Canada Oil and Gas Drilling Regulations and the Newfoundland and Labrador equivalents contain identical clauses on training of drilling personnel. Everyone employed as a drilling unit supervisor, drilling rig supervisor, drilling foreman or toolpusher must attend, and achieve a satisfactory standard on, an approved course in well control once every three years. The COGLA Guidelines will bring the regulation into force on 1 November 1983. The Provincial Minister's statement of 5 November 1982 also proposed a training seminar for the marine crew on drilling principles.

COURSES

Basic safety training

The Ministry of Transport marine emergency duties course MED II is divided into three parts, A, B and C, and CCG certificates are issued for each successfully completed part. Its content is laid down by the Ministry of Transport.

Part A is a one-week course on practical aspects of life-saving appliances, covering these topics:

- Lifeboats and lifeboat equipment
- Launching and embarkation of lifeboats associated with radial, luffing and gravity davits
- Launching and embarkation of inflatable liferafts and liferaft equipment
- Buoyant apparatus or rigid liferafts
- Lifejackets, lifebuoys, self-igniting lights and lifebuoy lines
- Emergency radio equipment
- Emergency and Abandon Ship Procedures

Part B, the firefighting course, also lasts one week and must cover:

- Portable extinguishers
- Hoses and related equipment
- Breathing apparatus
- Lectures on the characteristics of fires, their causes and prevention
- Practical firefighting training and experience

These two parts are examined by multiple-choice question papers.

Part C, a two-day survival and rescue course, instructs on Canadian and US search and rescue organizations, distress signals, aircraft and vessels in rescue operations, damage control and survival techniques at sea and on land.

A three day first aid course, leading to a St John Ambulance Brigade Certificate, is also mandatory. Some training institutions also include cardio-pulmonary resuscitation in their offshore first aid courses.

A MED III advanced course for senior personnel is in preparation, and is designed to give them experience in taking charge of lifesaving and firefighting operations. The course will last one week with one and a half days each on lifesaving, firefighting and ship handling and management. The final half day is for discussion and assessment.

The Canadian Coast Guard (CCG) controls all Canadian flag vessels and all MODUs in Canadian waters. It is responsible for approving all MED courses, and also the course instructors.

The EPOA/APOA Basic Offshore Training (BOT) which allows for four levels of training for casual visitors, occasional visitors (up to six days per year), occasional visitors (over six days per year) and regular workers. BOT Level I for casual visitors who do not intend to spend the night offshore comprises briefings at the heliport and on arrival at the unit. Briefing will cover safety precautions, emergency equipment and escape routes, and will be repeated at each visit.

BOT Level II training consists of a day's instruction onshore, including helicopter briefing and practice in a pool with safety and survival equipment. Fire fighting will be treated on video, but with practical first aid burn treatment. This is followed by a one to two hour briefing and familiarization tour on arrival at the unit.

Level III BOT consists of three days onshore followed by an off-shore briefing similar to Level II. The first half day consists of theoretical introductions - principles of survival, offshore hazards, organizational roles, alarms and appropriate actions, mustering and evacuation procedures. This is followed by two days at a pool becoming familiar with equipment and procedures. Lifeboat and helicopter practice is taught by video and lecture, but there is practical HUET. The final half day is on using fire fighting equipment, and safety orientated first aid must be studied in the evening.

BOT Level IV is a five day course, intended to provide essential safety training for regular offshore workers. It contains the following elements:

A. (1 day)
- Hazards associated with offshore environment
- Organizational roles and specific responsibilities under these
- Alarms and appropriate response (according to roles)
- Planned evacuation - procedural roles - escape corridors - group evacuation - principles of survival
- Leadership roles and liability under these

B. (1 day)
- Helicopter suits
- Abandonment suits
- Personal flotation devices
- Liferafts and equipment
- Pyrotechnics - sea dyes - EPIRBS
- Helicopter emergency equipment - rescue capabilities
- FRC/lifeboats and equipment - limitations of each
- Practical - helicopter embarkation and disembarkation procedures

C. (1 day)
- Helicopter evacuation - wet/dry
- Liferaft - deployment - entry - righting - equipment
- Suits - limitations and different applications
- Heli pick up - horse collar, scoop, net procedures

D. Sea day (1 day)
- FRC/lifeboat - launch - recovery - righting of capsized craft - clearing from unit
- Rescue with lifeboat of FRC - recovery and care
- Survival in lifeboat - communication - radio distress - alerting - radio emergency frequencies - extended operation - use of rations
- Measures against sea sickness and exposure to cold, wind, rain, preservation of body fluids, protein imbalances and water retention

F. Firefighting (1 day)
- Fire consequences - cautions
- Classes of fires
- Extinguishing agents
- Hand-held portables
- Water - fog - foam equipment
- Wheeled units
- Techniques and equipment maintenance
- Breathing apparatus
- Turrets
- Hose running
- Fire pans
- Smoke diving

Again supplementary first aid must be studied in the evening. It is envisaged that BOT Level IV will be supplemented by a company course on safety aspects carried out on the unit where the employee will work.

EPOA/APOA has stated the intention to set up advanced training courses for specialist personnel such as survival craft, fire teams and first aid staff.

Similar BOT courses at levels III and IV are offered by the Halifax company Survival Systems Limited. The criterion for level III is, however, spending more than twelve days offshore annually.

The Newfoundland and Labrador Basic Offshore Survival Training (BOST) Course lasts ten days. The first week deals with offshore hazards, fire prevention and control, under the following topics:

- hazards associated with offshore environment
- theory of fire
- extinguishment of fire
- causes and prevention of fires on drilling units
- fixed installations and detecting systems on drilling units
- practical use of portable extinguishers and wheeled units
- attack on fire (including demonstration)
- self-contained breathing apparatus and practical exercise
- international distress signals
- major fire-fighting appliances on drilling units and helicopter fires
- structure fire - practical exercise with self-contained breathing apparatus
- cardiopulmonary resuscitation, whole-day session.

Four evenings of the first week are occupied with SOFA, the St John's Ambulance Emergency Safety-oriented First Aid course.

The second week of the BOST course covers rig abandonment, rescue and survival, under the following topics:

- search and rescue, psychology of survival, preparation for abandonment and abandonment stations
- lifejackets, lifebuoys and lifecrafts, survival and immersion suits

- hypothermia
- TEMSPC
- pool exercises and drills
- boat work (one day)
- sea exercises
- helicopter safety and emergencies
- HUET training and exercises

There is also a one-day BOST course for personnel spending less than six days offshore per year.

Ballast control operator

In order to comply with the NLPD requirements, in the fall of 1982 and spring of 1983, some of the contractors conducted a five day course in St Johns. The comprehensive course manual is reported to be that for the seven week Marine Operations Supervisor course of Aberdeen Technical College.

On the Canadian registered MODUs off the east coast, the watchkeeping duties are undertaken by the Master and Mate, who also have final responsibility for stability. The ballast control operators hold Canadian First Mate (Intermediate Trade) or junior engineer qualifications and must have had at least six months sea time at the appropriate level before hiring. They are full-time ballast control operators. The unit owner has a 20 week training programme for them during which they begin in the control room with an experienced operator. Later they progress to hands on simple operations, still under continuous supervision. They must also study theory of stability, damage control and the systems in relation to the unit. The company also plans to send its operators to a ballast control operator course in Massachussetts which has a simulator.

TABLE 4.5 OFFSHORE TRAINING INSTITUTIONS (CANADA)

INSTITUTION	COURSES OFFERED	FACILITIES
PITS Training Centre Edmonton (APTIC)	BOP and well control	Simulator. Hands-on training at Golden spike well
Dowell Canada Training Centre	Six week oil well cementing course (50% safety content) Onshore	Associated laboratories
Camosun College BC	MED II Part C SAR, first aid only	
Pacific Marine Training Institute Vancouver	MED I, II (A B & C) MED III in prep	Pool with helicopter hoist simulator. New shared fire ground being built
CFB Shearwater (military)	(emergency routine practice)	Sea King helicopter simulator
College of Trades and Technology St John's	Offshore technology diploma, 2-3 years (unapproved)	Borrows any special equipment needed. Applied for new building which would include workshops and BOP training
SEDCO	One week stability training	
Bow Valley Offshore	Ballast control operator, 20 weeks post ON II	Ballast control simulator would be used if one was established within reach
Seafarer's Training Institute	MED II	Lifeboat, lifecraft on davits

TABLE 4.5 (continued)

INSTITUTION	COURSES OFFERED	FACILITIES
Survival Systems Limited	BOT II & III (3 and 5 day), BOT refresher course (2 day), Supply vessel rescue course (3 day)	Pool, HUET, fire-ground, lifeboat platform
DME Rescue, Edmonton	Specialist rescue team training (5 day), Coldwater marine survival seminar (2 day), Above water rescue techniques (2 day), Water based rescue techniques (2)	Audio-visual facilities, others not known
Institut Maritime de Quebec	MED II - 15 days	Pool. Helicopter pick-up from water simulation, smoke labyrinth, breeches buoy and basket, survival craft in pool
Niagara College of Applied Arts and Technology. MED Training Centre	MED II - 15 days	Vessel mock-up for fire training. Simple smoke environ ment. Survival craft in pool.
Nordco	Weather observation (3 weeks), Sea observation (1 week)	Microcomputers
Fenco Limited	Weather observation (9 days), Ice observation (1 week) In-house and radar night school	Microcomputers
College of Fisheries, Navigation, Marine Engineering and Electronics, St John's, Newfoundland	MED II - 15 days BOST - 10 days	Fireground, TEMPSC lifecraft on davits

4.4 A Comparison Between Training Standards

4.4.1 Basic Safety Training

Basic Safety Needs

On a MODU, most emergency duties are the responsibility of designated individuals or response teams. However, there are three basic things which everyone going aboard a unit should be able to do : act so as to prevent hazards arising; make a correct initial response to a situation which does arise; and act in the last resort for personal survival and to assist others to survive.

These requirements commence on leaving the airport terminal and continue through the various phases of the tour of duty : helicopter boarding and travel, disembarking aboard the MODU, living and working on board, and returning to shore.

The individual's responsibility in accident prevention consists primarily of using safe working procedures and following rules for helicopter safety, smoking restrictions, electrical equipment in accommodation, and general conduct. The major situations which require the 'first-response' ability include discovery of a fire, discovery of a man overboard, mustering with correct clothing and equipment and accidental injuries. This is especially acute when the Medic may take some time to reach remote points of the unit or when he is already occupied. In the 'last resort' category would be a helicopter ditching, supporting the fire teams, smoke or gas conditions requiring the use of breathing apparatus, and an abandonment of the MODU where conditions are such that the designated command team for the craft cannot function.

The abandonment of the MODU includes the survival phase. A person has not survived until he is safely ashore, and there are many responses and capabilities which may be required, of any individual, between successfully leaving the MODU and getting aboard the rescue craft, be it a vessel or a helicopter, and arrival at port of aircraft.

National Safety Training Requirements

The provision of basic emergency training for MODU personnel varies widely between the UK, Norway, Canada and the USA. The first two nations both have agreed standards: UKOOA Guidelines in the UK (UKOOA, 1980) and the LEIRO II syllabus with NIFO Recommended Practices in Norway (NIFO, 1982). In Canada, there are no such nationally accepted schemes. The Newfoundland Petroleum Directorate presently requires workers to go through the Marine Emergency Duties (MED) II course or its equivalent. COGLA has announced requirements to begin in November 1983, and both EPOA (1983) and the Newfoundland Offshore Petroleum Impact Committee have proposed schemes which are in the process of being implemented. The USA has no scheme for general basic emergency training of MODU personnel, although some companies provide varying degrees of instruction on board. The International Maritime Organisation (IMO) has proposed a draft form of emergency duties. It is likely to be several years before the final draft can be accepted as a convention.

The Norwegian LEIRO II syllabus provides the most formalised training schedule, comprising two weeks of offshore training, interspersed with a week of induction training into company practices. The course content, covering transport, safe working practices, fire and damage control and rescue is comprehensive. As noted in 4.3.3, the training is applicable to all Norwegian offshore workers, including those serving on fixed platforms and concern has been expressed that insufficient facilities are available to meet the training needs of the large workforce.

The effectiveness of training depends on the availability and quality of the teaching, as well as the syllabus. When the regulations came into force in 1982, the Norwegian sector was already developed. Presumably, when the backlog of training has been cleared, existing schools will easily cope with the demand for new entrant and refresher training.

No conclusions can be yet drawn, for instance from accident statistics, as to the effectiveness of training, and the major disaster to the semi-submersible 'Alexander L Kielland' occurred in circumstances which rendered conventional training methods invalid.

The British legal requirement that everyone on a MODU should be suitably trained, while not specifying the nature of the training, has resulted in the industry drawing up the comprehensive UKOOA 'Guidelines' to meet the requirement, allowing for the differing needs of various classes of offshore workers. The OPITB, RGIT and associated training schools provide suitable courses to meet the need for training. As the Guidelines themselves have no legal force and 'suitably trained' can be interpreted as something less, the operators find difficulty in enforcing them on their contractors, particularly where the contractor is the owner of a MODU with a crew largely comprising sub-contract personnel.

There are sufficient schools in the UK to provide for its training needs and in fact at least one is approved by the Norwegian Maritime Directorate, to offer LEIRO training.

There are no statutory requirements for basic safety training on US MODUs. One major reputable operator commented to the study team that onshore survival training was not warranted for everyone. In view of the relatively high turnover among drilling personnel, it is clearly not in the interest of a MODU owner to train personnel who will shortly leave the industry or be working for a competitor.

In Canada, the requirement for a MED certificate, or equivalent training, goes some considerable way to meeting the needs for a framework for training, but as observed by the EPOA/APOA safety task force, the MED course is designed for shipping operations, and therefore lacks specific MODU content. In addition the course was considered too long for an initial basic safety training, by some operators.

The EPOA/APOA proposed BOT course, offering four levels of training, satisfies some of the industry requirements for differing training levels for various classes of occasional visitors and for regular offshore workers. The Newfoundland and Labrador BOST course covers the major fields of fire and helicopter emergencies, abandonment etc, and first aid, hypothermia and CPR. The course format, of two separate weeks, with first aid as an evening/Saturday supplement, meets some requirements for a course which will fit in with offshore work patterns.

Two schools in the Eastern Canada Offshore area are equipped to provide basic training to current standards for the likely number of workers in the region, in the near future.

Conclusions on Basic Safety Training

General:

1. Norway, the UK and Canada all require some basic safety training. This training is not required in the US.

2. In Norway the standards are laid down by government, in the UK the industry has established standards through the UK Offshore Operators Association, to meet a general government requirement. In Canada, the National and Provincial Governments set standards, accepting equivalents.

3. The standards in the UK and Norway are similar to those in Newfoundland (BOST), with permanent offshore workers spending about two weeks on accident and fire prevention, fire fighting, first aid, survival craft operation, water survival and helicopter underwater escape.

4. The EPOA/APOA BOT involves five days training for regular offshore workers. There are three levels of lesser training for grades of casual worker. Conditions are comparatively benign off Nova Scotia. Newfoundland, where conditions are worse, does not accept BOT.

5. The North Sea countries have an adequate number of well equipped training centres (there may be some shortages at times of peak demand).

Training needs in Canada:

1. There is a need for persons on MODUs off Eastern Canada to have basic emergency training, appropriate to the harsh environmental conditions.

2. The content of a suitable course should comprise two main core components, namely: Offshore Hazards, Fire Prevention and Control; and Rig Abandonment, Rescue and Survival, to be taken by all regular workers. The cores should be supplemented by lectures, demonstrations and hands-on experience in Helicopter Procedures; Cardiopulmonary Resuscitation (CPR); Emergency Safety Oriented First Aid (SOFA); and Hyperthermia, to be taken by selected persons.

3. The MED II standard required by the national Government is not specific to MODUs. The Nova Scotian BOT and Newfoundland BOST, are designed for MODUs. Comparison between these and the Norwegian and British curricula would assist in devising the optimum course.

4. It is necessary to have different categories of training for persons spending different amounts of time offshore.

5. Suggested categories are:

Occasional workers	(up to three or four visits with no over-night stays)
Seasonal workers	(up to twelve nights per year offshore)
Regular workers	(over twelve nights per year offshore).

6. Training should be given in procedures to all who may have occasion to use radios.

7. Consideration should be given to harmonizing training standards throughout the region, taking due account of the different environmental conditions.

8. A review should be made of the facilities in the existing training establishments to ensure that they are adequately equipped and staffed to provide training for expected numbers of trainees.

4.4.2 Specialist emergency training

The main response to various emergencies is still planned to be handled by specialists, possibly supported by those with basic training.

There are two justifications for requiring trained specialists. The first is that it is not necessary or feasible to train all on board to the high level of proficiency required to handle specialist equipment. The second is that some actions are better done, or can only be done, by a team which is practised in co-ordinated working.

In training for team objectives it is important to maintain a balance between theory and practical exercises. The individual must be trained to interchange with other team members in the use of equipment and in performing their duties.

Typical examples requiring specialist or team training are:

Damage Control Team
Firefighting and B/A Rescue Team
Fire Leader
Helideck Fire Fighting (Heliguard)
Man Overboard Boat
Survival Craft Coxswain
First Aid Team.

Damage Control Team :

Following the loss of the Ocean Ranger, COGLA sent a telex to all operators of semi-submersibles on the Canadian Continental Shelf which states that '... evidence is needed showing that the crew have sufficient damage control training to be able to open or close valves manually on the vessel under emergency conditions in order to maintain trim. This should include a demonstration of a damage control team at work' (Royal Commission Exhibit 110).

In response to questions during evidence, the Director General of Engineering for COGLA stated there was no requirement for damage control teams at the time the Ocean Ranger went down. Even now the major concern appears to be with ballasting, and the manual operation of valves, and no set standards for the team have been laid down. In this study, damage control has been taken to embrace much more than opening and closing valves and includes primarily hull or structure damage, loss of watertight integrity, and emergency counter measures.

These aspects, as they apply to ships, are part of the regular training of Masters, Mates and Engineers, in all countries considered. In the US, stability and safety and emergency procedures are subjects of the examination for special industrial Master or Mate. For special industrial Chief Engineer, the syllabus includes 'industrial safety operations applicable to engineers', but whether this includes damage control is not known. In Norway, the Mate (Stability Section Leader) and Watchstanders (Control Room Operators) should have training experience in ballasting operations, including correction of damage, but in the latter case the certification requirement has not been enforced. The LEIRO basic safety courses, for all offshore personnel include damage control instruction in parts I and III. Part II requires training to be given in the 'arrangements, systems and equipment' on the particular unit.

Firefighting and Breathing Apparatus Rescue Teams:

At present in Canada there are no regular, specialist or team courses available for MODU fire teams. Operators and contractors send their personnel to the USA or overseas for such training.

In the US, apart from any training required of marine officers, and the safety and emergency procedure requirements of the specialist industrial licences, fire training is not required by law although fire training courses are available, usually in schools associated with universities.

In Norway, the UK and the Netherlands there are a number of schools offering advanced fire training. Schools offering courses include the Offshore Fire Training Centre, Montrose, Scotland, the Statens Havarivernskole in Norway and the Wormald (Ansul) school in the Netherlands.

Fire Team Leaders:

Firefighting teams on drillships follow the traditional marine pattern. In small vessels the Mate and Second Mate are in charge of firefighting teams which are made up of seamen. In larger vessels a supervisor such as the Boatswain is normally in charge.

On other MODUs, Fire Team Leaders may be Mates, Barge Engineers or Crane Operators. The drill floor Fire Team is usually led by the Assistant Driller.

Some Fire Team Leader courses are currently available in Europe, for both marine personnel and supervisors on MODUs. Fire Leader courses include supervising the fire fighting operations, organizing fire drills, assessment strategies, and taking correct action in tackling a fire. Emphasis is also placed on fire prevention, and the detection and rectification of unserviceable equipment. Basic and team training courses are usually pre-requisites. MODU-orientated courses are held at the OFTC at Montrose and Statens Havarivernskole. Marine-oriented courses were noted at the College of Nautical Studies at Southampton and Statens Sjoaspirantskole in Bergen.

With the advent of MED III late in 1983, similar opportunities have become available in Canada, although the present syllabus is vessel oriented, as with MED II.

Helicopter Fire Course:

All regulatory bodies require fire fighting and rescue equipment to be located around the helicopter deck and adjacent areas. Regulations or operating procedures also call for personnel to be on station when helicopters are landing and taking off, and during special circumstances. In the UK the designated Helicopter Landing Officer must ensure that 'the fire fighting equipment for the helicopter landing area is manned by adequately trained persons' (SI 1976 No 1019). The two day Helicopter Fire Course at Montrose is approved by industry and government in the UK. The Offshore Basic Fire Course is a pre-requisite. Similar courses are available in Norway at Statens Havarivernskole, and at the Norder Haaks Nautical College in Den Helder in the Netherlands. These facilities all include a simulated helideck and helicopter fuselage.

Persons taking these courses learn to operate the various combinations of helideck portable and fixed fire fighting systems while wearing fire proximity clothing. They also learn to rescue persons from a burning helicopter using the typical rescue equipment available on MODUs, together with techniques using two fire fighting media in combination. Helicopter types, their construction, materials, danger points and entry areas are covered, together with precautions against refuelling fires and the correct actions in the event of such a fire.

Man Overboard (MOB) Team:

While a certain reliance is placed on the standby/ rescue vessel to look after this particular emergency, each MODU has a MOB station bill and designated response team. A typical team (taken

from the Neddrill station bill) might be the Barge Engineer in charge of the pick-up boat with two Roustabouts as crew, others on lookout duty, the Crane Operator in the crane to launch and recover the boat, and the Mechanic standing by to start engines. The Radio Operator would contact the standby vessel, and the Medic prepare to handle the casualty. For some of the team these are part of their normal duties, but not for the boat crew.

Man overboard boats on MODUs may be small open boats, Zodiac type inflatables or fast rescue boats such as fitted to some standby/rescue vessels. Launching is usually done either with the crane or by conventional davits.

The study team is not aware of any special MOB training courses other than those on fast rescue boats, intended for crews serving on standby/rescue vessels. On the MODU, MOB training usually takes place only at drills.

In Canada and the USA, there are no regulations on how MOB drills shall be conducted, only that drills are to be carried out once a month. Some MODU owners such as Zapata Offshore issue very specific instructions to their MODU senior personnel on this subject. These include measuring the response times, both of those onboard and of the standby vessel. In the UK, man overboard drills every two weeks are part of the UKOOA Guidelines, but only involve craft launched from standby vessels.

Survival Craft Coxswain:

Basic courses cover lifeboat operations only to a rudimentary level. There ought to be sufficient personnel onboard who are fully trained in survival craft operation and command under survival conditions. This is standard practice in the North Sea offshore industry. USA practice is generally to have key personnel acquire a lifeboatman's certificate (5-8 days course) or an AB document which incorporates it. For the Canadian marine industry, MED II is considered to incorporate sufficient training.

Survival Craft Coxswains courses usually take one or two days with the basic course as a pre-requisite. The aim is to train persons in commanding small groups and in all phases of survival craft operation, from boarding to eventual rescue, with concentration on practical training.

First Aiders:

Contingency plans off the east coast of Canada incorporate the raising of specialist medical teams to cope with emergencies. Simulated training exercises have been useful in identifying the strengths and weaknesses in the plans.

In addition to the primary medically trained person (Rig Medic), the muster list usually indicates that some crew members are assigned to first aid parties, to act as stretcher bearers or to generally assist in the handling of casualties.

Medicor is studying all aspects of first aid and offshore health and safety.

Conclusions on Specialist Emergency Training

General:

1. No country has sufficiently addressed the subject of specialist emergency training, although in Norway and the UK numerous courses are available and are used by industry.

2. Some individuals, such as lifeboat coxswains and some groups, such as fire and damage control teams, need specialist training. General safety training does not sufficiently address specialist needs.

3. Where training is provided it is generally thorough and realistically simulates actual emergency conditions.

Canadian needs:

1. The isolated, distant nature of the industry makes self-help emergency action particularly important for the region.

2. Little emergency team or specialist training is available in Canada, and facilities need to be developed, probably at existing institutions offering basic safety training.

3. Subjects to be covered should include damage control, team and specialist fire fighting, man overboard and survival craft handling.

4. Conditions must accurately simulate those found in service and training exercises must be carried out in the most severe conditions practicable without hazarding the trainees.

5. Regular drills and periods of refresher training are needed by specialists to keep them in preparation for an emergency.

4.4.3 Marine Crew Training

Persons in Charge

In Norway, the person in charge must always be a Ship's Master. As such he will have training and experience in maritime matters, including emergencies. In addition he is required to have one or two years experience in a senior position on a MODU, which will help him to apply his maritime expertise to the new situation.

The six week platform manager's course covering drilling technology, oil industry matters, law and rig manouevering, provides most of the additional knowledge required by a mariner in order to manage a MODU.

The United States requirement for a Master Mariner for drillships and self-propelled semi-submersibles on passage, involves no additional statutory training. For other units where a qualified Master Mariner is not required, the Special Industrial Master's licence appears to offer a very sensible solution. The fairly onerous service requirements - at least three years service on a MODU, one in a supervisory position - mean that the candidate will be experienced and knowledgeable and will therefore be able to absorb a great deal from the training. However, a qualification which can be obtained after only 15 to 20 days of formal training, while appropriate for Gulf of Mexico conditions, may not be be adequate where marine operations are more onerous.

For both Canadian and British registered MODUs the person in charge must hold a Master Mariner's certificate. The UK requires no additional training over and above that required for his certificate, but most attend a two or three day Offshore Installation Manager's course, although these courses are designed to give a Manager information on his legal obligations, rather than an insight into operational aspects of MODUs. In Canada, since September 1983, Masters of MODUs are required to attend the five day MED III course.

For foreign MODUs operating on their continental shelves, both Canada and the UK require a person to be nominated as being in charge, but the responsibility for the appointment of a suitable person rests with the owner and no training requirements are laid down. Again, in the UK, most foreign owners send their Managers on the OIM course, to give them a grounding in the UK administrative requirements.

First Mate

In the US (when a fully licensed mate is required by the Coast Guard), Norway, the UK and Canada, the first mate of a MODU must have an appropriate mariner's certificate. In Norway (where the mate is known as the Hull and Stability Secion Leader), the certificate may be either as mate or engineer, but in addition he must have taken a special course, comprising 14 one week modules in stability and MODU operation. None of the other countries imposes special requirements for marine training.

In the US when a fully certificated mate is not required, a Special Industrial Licence will suffice. The same advantages of industry relevance and the same reservation, about the brief training period required, apply. When no mate is required - for a unit on station or on a short, unassisted tow - there is no requirement for any training of a marine nature.

Ballast Control Operator

In the US, although there are no legal requirements, training is available either using a simulator on a five day intensive course, or the IADC/PETEX self-instruction workbook. The latter is very basic, but provides an introduction to the subject. Operators are taking the lead in developing higher standards.

In Norway, the Control Room Operator is responsible for ballast operations, and he must in addition to basic marine or technical

training have specific training in control room operations, including ballasting, but this requirement cannot be enforced as the six week course has only recently been introduced.

There are no specific requirements in the UK or for UK flag vessels for the training and certification of Ballast Control Operators. The owner must provide suitable competent persons to ensure safe operations.

Since February 1983, a working party of representatives of UKOOA and the IADC (North Sea Chapter) has been considering recommending the development of a voluntary system involving a standardised syllabus of training leading to certification. This could be presented to government as a Code of Practice (SCOTA 1983, personal communication). As an intermediate step SCOTA recently introduced a four day course aimed at BCOs, Barge Engineers and other supervisory level personnel. The course is an introduction to basic principles of stability.

Two years ago, in collaboration with SEDCO, the Marine Department of Aberdeen Technical College introduced a seven week Marine Operations Supervisor's course. The level is such that graduates can normally pass the examination for the USCG Special Industrial Master's certificate. The four or five day stability and damage control module of the course is now offered separately and there is a final examination for a college/industry certificate for Ballast Control Operators.

In Canada, it is a requirement of COGLA and the NLPD that for any unit operating off Newfoundland or Labrador, Ballast Control Operators must have attended an approved course and a course has been organised by some of the contractors in St John's as noted earlier. The practice of one owner of a Canadian MODU is to employ full time Ballast Control Operators with Canadian First Mate (Intermediate Trade) or junior engineer qualifications, with at least six months sea time in these grades. The owner has a twenty week training program which begins in the control room

with an experienced operator, and progresses to hands-on operations, still under continuous supervision. Trainees must also study theory of stability, damage control and the systems in relation to the unit.

Watchstanders

In the US, Norway and UK there are requirements for flag of registry MODUs to carry able seamen, their equivalent or more highly qualified marine personnel who are able to maintain a marine watch. In Norway, the Control Room Operator, in addition to his ballasting duties, is responsible for monitoring nearby traffic and the Control Room Operator's course covers these aspects.

Chief Engineers and other Engineers

In the USA, most companies train Engineers in-house and offer on the job video, slide and tape presentations, packaged courses or send potential engineers on a variety of short courses, either in-house or external. Western Oceanic courses are described by Adkins (1977). The USCG issues certificates as Chief Engineer and Assistant Engineer of 'column stabilized or self elevating mobile self propelled motor drilling vessels of any horsepower'.

In Norway, the Chief Engineer is known as Technical Section Leader. In addition to holding a certificate of Competency, Marine Engineer Officer Class 1 (Machinery or Electro Automation) or Chief Engineer's Certificate, and having at least one year's experience as Technical Assistant on a MODU, he must undergo an approved course of training for Technical Section Leaders.

In the UK, engineers as required by the Department of Transport for British Registered Vessels require no specialised training for MODU working. For units working on the UK Continental Shelf a number of the 'competent persons' required, particularly those concerned with electrical, mechanical and lifting equipment, are

often combined in the person of Chief Engineer or maintenance supervisor, but no training is specified.

MODUs of Canadian registry carry Engineers who hold First and Second Class Engineering Certificates. These are conventional merchant vessel qualifications and the details of the examination requirement can be found in Chapter 1443, CSA Marine Examination Regulations. There are as yet no special requirements for training and certification as engineers on MODUs under Canadian regulations.

Radio Operator

In the US, Norway and the UK a Radio Operator Second Class Certificate is the generally accepted qualification on MODUs fitted with radio telegraphy and engaged on 'foreign' voyages. It is not unusual for an exemption to be granted, however, since trans-ocean voyages are fairly infrequent for most semi-submersible and jack-up MODUs, and they are almost always accompanied by other vessels. This is not so for drillships, which usually carry certified Operators as on merchant vessels.

Internationally, standards of training for radio operating certificates are very similar. The certificates of all the countries included in this study compare well with Canada's. Norwegian MODUs must carry two Radio Operators with Marine Second Class certificates.

Details of requirements for current Canadian certificates are contained in Telecommunications Regulation Circulars TRC 31 for Radiocommunication Operator's General Certificate (RGMC) and Radio Operator's Second Class Certificate; TRC 32 for Radiotelephone Operator's General and Restricted Certificates (ROG and ROR). These syllabi are somewhat outdated concerning modern telecommunications technology. Satellite communications (SATCOM), telex and facsimile transmission is still required in Radio Operator's certificates. This is an IMO convention for the higher level certificates. These are primarily directed at ocean going ships which may often find themselves beyond voice communication range without satellite systems aboard.

The Department of Communications set up a 'Radio Operator Task Force' in conjunction with CCG and other interested parties. This Task Force has produced several drafts of a revised certificate structure. This is presently being finalised, however to date there is no recommendation for a single standard for MODUs. They will continue to have varying certificate requirements according to type, equipment fitted and activity (coastal or ocean transit).

Training courses for all certificates except the Restricted Radiotelephone are generally between six months and two years long. In all countries major radio technologies (MF, HF, VHF) are covered, but most standard courses are weak in some of the newer telex, telemetry and satellite transmission systems.

Crane Operator

There is no requirement in the US for crane operator training. Industry practice is to use instructors from onshore groups, such as the Crane Industry Certification Board, or send the Operators to the Board's school in Florida. For a new Operator, on the job training is supervised by the Barge Engineer, and in some companies, a structured training program is used, combining the above with video tapes and work books. Guidelines on the training of offshore Crane Operators are published by API.

In Norway, the regulations on qualifications require that as a minimum, a Crane Operator has served on a MODU or platform for six months as a Roughneck or a Roustabout, completed a training course approved by the Maritime Directorate, and has had 150 hours' experience in operating cranes on a MODU under the supervision of a licensed Crane Operator. Onshore Crane Operator licences are accepted, but an assessment is made of the Operator's experience, and additional training may be required. Approved courses, usually two to four weeks in length, are conducted by a number of state, oil company and manufacturer training centres. These are all onshore, and comprise mostly classroom and workshop sessions.

In the UK there is no formal requirement for training, but industry practice is now for all new operators to be previously trained. Several private crane companies conduct courses for Crane Operators on land and some will send instructors offshore to train operators actually in the cab. SCOTA and PETANS offer courses, but there are no facilities for practical crane training in an offshore environment. This is taught using video tapes and verbal instruction.

Crane operation in Canada, onshore or offshore, is not as yet regulated. There are no schools or courses in Canada which train offshore Crane Operators. Canadian owners of MODUs use schools in the US, particularly that of the Crane Industry Certification Board, in Florida (see USA below).

Helicopter Landing Officer

There are no established courses in the USA or Canada for those concerned with helicopter operations other than company in-house programs.

In the UK, there are no formal requirements for training, but as the requirement is to provide a competent person to be in charge of helicopter operations most companies use the special two day courses offered for HLOs by PETANS and SCOTA. The course covers the safety and working procedures concerned with the job and has been developed as a result of cooperation of all parties concerned including the helicopter operators, Civil Aviation Authority, UKOOA, and the Department of Energy. As such it is effectively an 'approved' course, although it has no official status.

The requirements on mobile drilling units in Norwegian water are essentially similar to Great Britain's.

DP Operator

Only Norway has formal requirements - a First Mate's certificate. Training is usually on the job as a trainee or supernumary.

Manufacturers such as Kongsberg or CIT-Alcatel offer basic operation courses, but owners usually only send personnel for new units to these. The original personnel train their successors on the job.

The only courses found for DP Operators outside the manufacturers is offered at Haugesund Maritime High School in Norway, and began in February 1983. There is a hands-on simulator course for operators, for which no previous experience or sea time is required. A second course is designed to be taken after three to four months as a trainee at sea, and incorporates instruction on the system, fault finding and rectification. Software is available to simulate a 65m diving support vessel, a 120,000 ton tanker and a semisubmersible, in various sea and weather conditions. The tanker could closely simulate a drillship. Emergency loss of positioning is included in the courses.

The United Kingdom Nautical Institute has made a proposal to the Department of Transport for formalization of DP Operator training and this is under consideration.

Ice and Weather Observers

The only formulated requirement for the training of observers is in Canada, which is to have passed the aeronautical and maritime weather observation examinations of AES. Companies arrange their own training when AES has approved their instructors. Examinations for the supplementary aeronautical weather (SAW) are administered by AES staff. Most new Observers need about eight to ten days to learn meteorological equipment, observation and standard recording formats. In addition, companies provide about two days' training on company procedures and oceanographic equipment and observation.

For Observers going to units where icebergs may be expected, the companies arrange additional in-house training on ice plotting. This training is usually given to very small groups or individuals. One company's employees take an evening program (ten hours) on the radar simulator at the College of Fisheries,

St John's. The course was designed by the College and company personnel. Another company's Observers are trained in radar observation on company equipment.

Conclusions on Marine Crew Training:

Person in Charge:

General:

1. The Person in Charge must fully appreciate the relationship between drilling activities and the capabilities and limitations of the unit.

2. Neither a Master Mariner nor a Toolpusher can be assumed to have all of the necessary knowledge and appreciation to command a MODU without specific training (however obtained) directed towards operations of the MODU type concerned.

3. Canada has, at present, no system for conducting, approving or certifying either MODU-related training for Masters or marine training for Toolpushers.

4. THE USCG Special Industrial Master's Licence, while offering a conceptual model, does not require sufficient depth of knowledge for safe operation in the harsh Eastern Canadian marine area.

Canadian needs:

1. Consideration should be given to establishing a course, to familiarize licensed Masters with the special aspects of MODUs and drilling operations. The course could lead to a 'MODU Masters' endorsement.

2. For jack-up units on station, the toolpusher could appropriately be the person in charge. A course should be developed to provide such a person with suitable

familiarization with Eastern Canadian offshore conditions and provide training in marine emergencies.

Mates:

General:

1. Canada has no system for conducting, approving or certifying specific training for MODU Mates. The only domestic unit to date is crewed by Mates holding marine certificates. The MODU-specific training on this unit is organized by the operator.

2. A Mate on a MODU on location has only some of the duties of a merchant vessel Mate, but he has some additional duties which are unique to the job. The USCG Special Industrial Mate's Licence is designed to provide the necessary training for all of these duties. However the examination standard is low compared to regular marine certificates, but may be satisfactory for the sheltered waters of the Gulf of Mexico.

3. Standard marine training is a good foundation for the training of MODU Mates, although it does not address the special features of MODUs. The Norwegian MODU Stability Section Leader certificate course supplies the additional training.

Canadian needs:

1. Company MODU training for Mates would be appropriate but there are few suitable positions available where practical experience in a junior capacity can be obtained.

2. Since the Mate is a central figure in an emergency on board he should be trained to an advanced standard in fire fighting, damage control, man overboard and the deployment of survival craft.

Watchstanders:

General:

1. The Watchstander has a central role in the operational marine safety of semi-submersibles, particularly in respect of ballast control functions. On most units, he has other duties as well, often similar to those of a marine watchkeeper.

2. There are as yet no widely accepted standards in Watchstander's training. Only Norway has any formalised program. Elsewhere there has been a great deal of recent activity in developing new courses, many directed to the stability of semi-submersibles. This is a necessary part of a Watchstander's training but is not in itself sufficient.

3. Watchkeepers on drillships are certified mariners. Their duties are consistent with normal marine practice and are adequately covered by regular training programs. There is no equivalent position on jack-up units except during moves, when normal towing practices are followed. These are adequate.

4. Canada has no published standards for Watchstander's training for domestic or foreign units on the Continental Shelf.

Canadian needs:

1. Watchstander's training should include stability of multihull MODUs both when intact and damaged, ballasting procedures in the event of damage or loss of the main control system, as well as the effects of anchor tension on stability and trim of MODUs, and other aspects of his duties as required. The Watchkeeping Mate certificate would be a good basis on which to develop courses.

2. Watchstander's training should include some instruction on the actual unit's system. Consideration could be given to independent examination of his knowledge.

Engineers:

General:

1. In Canada, there is a general shortage of persons holding a First Class Engineer's Certificate.

2. In Canada, there are no specific MODU related training courses or examinations for engineers on MODUs under CCG regulations.

3. The Engineer is a senior person whose expertise is critical in times of emergency involving mechanical and electrical breakdowns and malfunctions.

4. Current examination standards to normal First or Second Class marine certificate levels, or their equivalent, appear adequate. The USCG MODU Engineers examination is of a lower standard, and may not be appropriate in Eastern Canada.

5. Norway is the only country which requires a licensed engineers (or equivalent) to take special MODU endorsement courses in addition to their Marine Engineer Office training. The Norwegian Technical Section Leader's certificate is issued after succesful completion of this additional training.

Canadian needs:

1. Consideration should be given to setting up a course to enable suitably qualified engineers (not necessarily marine) to understand all the requirements of MODU machinery and systems. This could be used as the basis of 'MODU engineer' certification.

Radio Operators:

1. The Certificate required by a MODU Radio Operator is based on the marine radio equipment fitted where the unit is classed as a ship.

2. The present restricted radiotelephone operator's certificate does not itself indicate a sufficient level of competency to be Radio Operator on a MODU. It can be satisfactory if the employer provides adequate supplementary training in the operation of specially installed equipment and in company and other emergency procedures.

3. Where the MODU carries operators with marine certificates higher than the restricted radiotelephone operator's certificate, the training is adequate. The earth station endorsement proposed by the DOC/CCG task force would be beneficial where the MODU is equipped with a satellite communications system.

Crane Operators:

General:

1. Crane operations, if not properly conducted, can pose considerable hazards to the MODU or to an associated vessel.

2. In Canada, there are no regulations requiring training or certification of offshore crane operators, nor are there any specifically organized courses for crane operators.

3. In Europe and the US, crane operator courses are available and on the job tutoring is also common. US training is usually on the job with packaged instruction and theoretical courses.

Canadian needs:

1. Consideration should be given to establishing a facility for realistic offshore crane training in Eastern Canada.

Helicopter Landing Officers:

General:

1. The position of HLO is not officially recognized on most units operating off Canada, and is not filled by any particular class of crew member. No specific training takes place other than that obtainable on the job.

2. In a complex and potentially hazardous situation, the presence of a trained person, able to understand the sequence of events and react to any incident is essential.

Canadian needs:

1. A committee, comprising helicopter operators, MODU owners and government, should be set up to consider existing European training courses, with a view to requiring similar training in Canada.

DP Operators:

General:

1. Good on the job training can be adequate, if subject to management commitment and control, except for emergency actions which must be rehearsed under simulated conditions.

2. Simulator training is the only practical way to practise emergency actions, and if realistic is adequate.

Canadian needs:

1. Consideration should be given to the establishment of a suitable course, and the provision of simulator facilities. This may not be necessary if DP equipment suppliers can provide adequate training.

Weather and Iceberg Observers:

1. The training of Observers appears to be adequate for their tasks.

2. The policy of new Observers being accompanied by experienced personnel is a good safeguard, as well as providing on the job training enhancement after the initial onshore courses.

4.4.4 Key Drilling Crew Training

Toolpusher (Person in charge of drilling)

All countries have some requirements for training of drilling personnel, although these are not actually particular to offshore drilling. Because of the additional potential dangers of drilling accidents at sea, these training requirements have however been considered.

The toolpusher may or may not be in overall command of a MODU, but his key role must be to prevent a well incident, which could develop into a major blow out with possible consequences of severe pollution and massive loss of life. The training requirements of all countries studied reflect this.

In the US the toolpusher must have taken a course in well control, approved by the US Mineral Management Service, and passed a test involving simulator work.

In Norway, the requirement is somewhat different, training being partly designed to build up a national capability in drilling. The toolpusher (known as Drilling Section Leader), must have completed a comprehensive course of education, interspersed with practical experience and must have progressed 'through the ranks' of the drilling hierarchy. The education and examination includes well control. The responsible body is the Norwegian Petroleum Directorate. Training and certification is mandatory for the sub sea engineer, responsible for the sub sea BOP.

In the UK, the only requirement is for the drilling supervisor to have passed an examination in well control. The examination is set by the OPITB, and a certificate issued, signed on behalf of the Secretary of State for Energy. There is no mandatory requirement for a course of study but most candidates take a three or five day course at OPITB or a commercial school. The examination must be retaken every two years.

In Canada, on the East Coast, the federal administration has approved a number of courses in well control and a toolpusher (and drilling unit supervisors and drilling foremen) must satisfactorily complete such a course every three years.

Other drilling personnel

In the US all drilling personnel, from roustabout up, must have some training in well control. From driller upwards the requirement is similar to that for toolpusher, but for floor hands and derrickmen, the requirement is for on the job training and drills, supervised by the Mineral Management service on a spot-check basis.

In Norway, the comprehensive training program for drilling personnel embraces all from the roustabouts to senior toolpusher. Exemptions are granted for persons with previous experience (usually senior personnel who are brought in because insufficient Norwegian nationals had received training).

In the UK, drillers must have a well control certificate. The procedure is the same as for toolpusher, with a test to be taken every two years, but the test requirements are a little less severe.

In Canada, there are no formal requirements for training at lower level than toolpusher, although the general requirements apply, that persons shall be competent to perform their normal duties and handle emergencies and shall be given regular drills.

Subsea engineer

Only Norway makes special requirements for subsea engineers, requiring two years mechanical and hydraulic engineering experience and training on the specific equipment. Two years in technical school or a second-class Marine Engineers' Certificate or NPD training as a driller are also required.

Conclusions on Key Drilling Crew Training

General:

1. Most countries require well control training, at least for key personnel.

2. Apart from in Norway there are few comprehensive requirements for training of drilling personnel in their routine work skills.

Canadian needs:

3. Adequate well control training is necessary for all key offshore drilling personnel. It should include instruction on the sub sea BOP, unless in the case of a jack-up, this is not used.

4. Sub sea engineers need to be well trained in the use and maintenance of the sub sea BOP.

5. There are adequate facilities for drilling training in Canada, but there is a need for consultation between Government, industry and the educational sector to make the best use of them, for specialist offshore training.

6. Reciprocal acceptance of Canadian well control certification with that of other countries should be sought. Due to the nomadic nature of the industry it is a great advantage if drilling personnel can operate in other countries without re-certification.

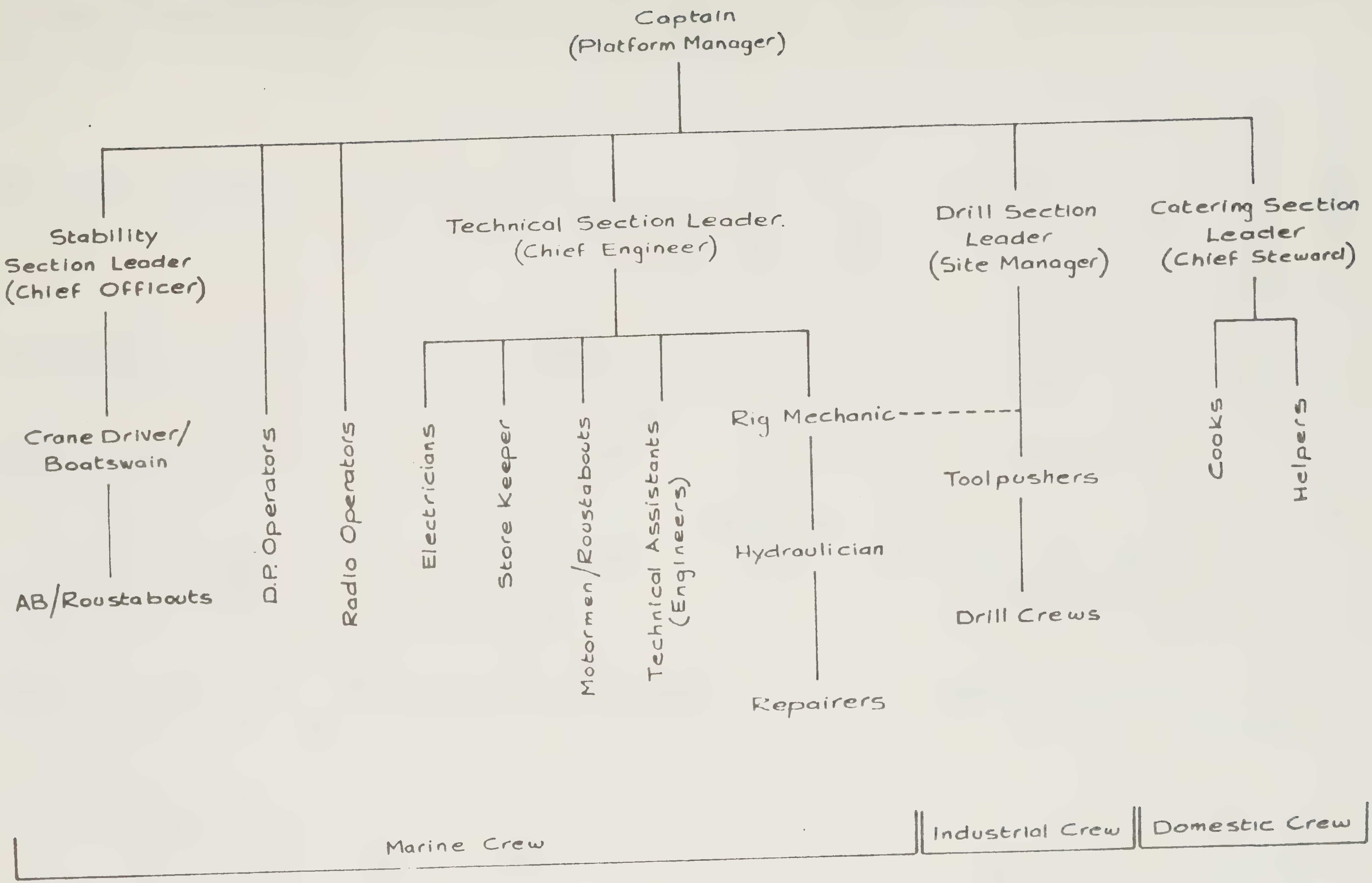

Fig 4.1 Manning of Typical Norwegian Drillship.

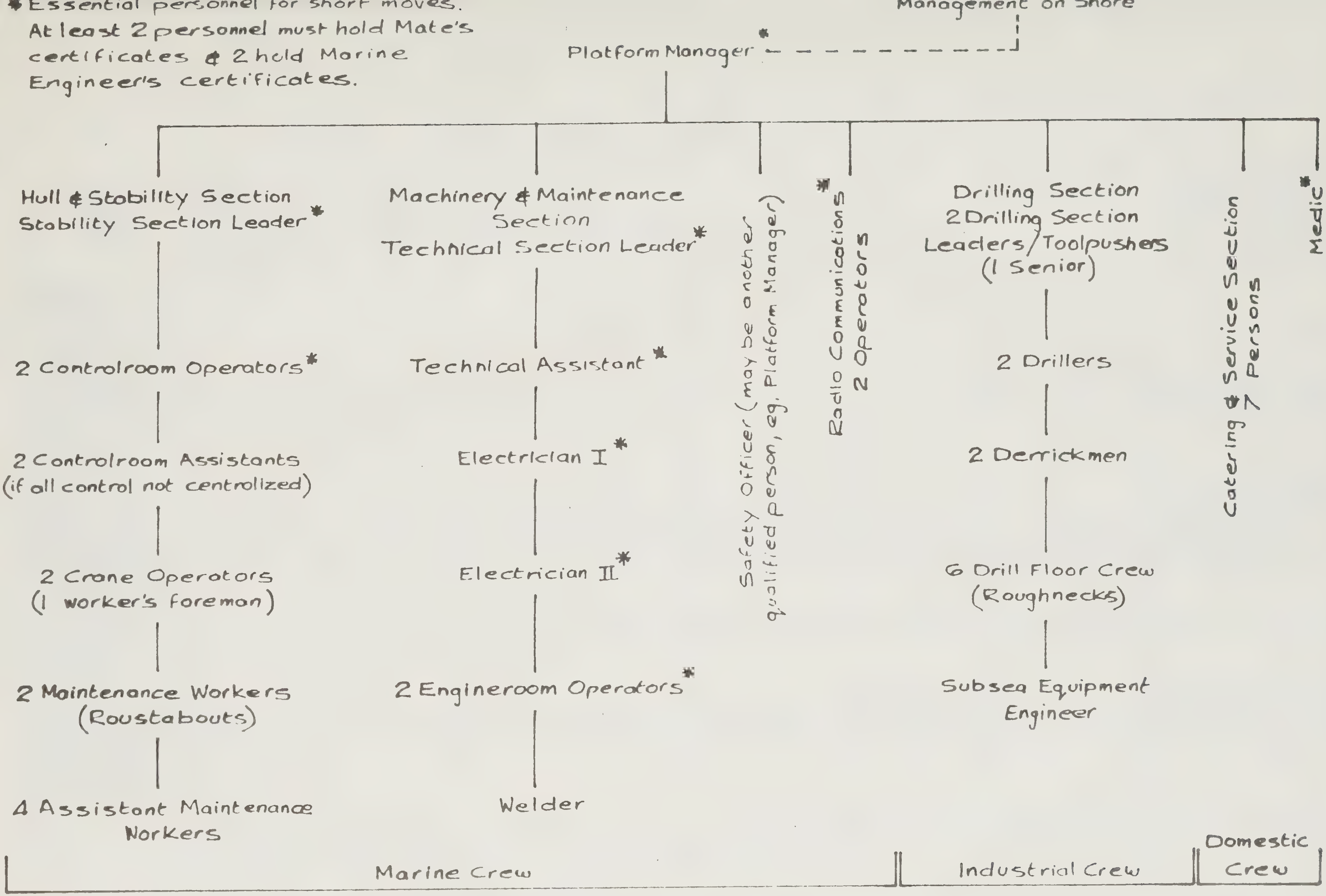

Fig. 4.2 Norwegian Mandatory Manning Structure for Semisubmersibles.

MARINE PERSONNEL CATEGORY	REQUIRED PERSONNEL COMPLEMENT							EXAMPLES OF MODU PERSONNEL WHO SOMETIMES FULFILL USCC MANNING
	TOWED UNIT PROVIDING NO PROPULSION ASSISTANCE[1]	TOWED UNIT PROPULSION ASSIST[2]		INDEPENDENT SELF-PROPELLED UNIT[2]			UNIT MOORED ON STATION	
		FIELD MOVE	OCEAN VOYAGE	FIELD MOVE (16 hr)	INTERMED. MOVE (16-72hr)	LONG MOVE (72 Hr)		
<u>MASTER</u> UNLIMITED CONVENTIAL LIC				1	1	1		
SPECIAL INDUSTRIAL LIC			1				1	(Toolpusher, Rig
UNLICENCED	1	1						(Mover, Barge Eng.
<u>MATE</u> UNLIMITED CONVENTIAL LIC						1		
SPECIAL INDUSTRIAL LIC			1	1	2	2		Toolpusher, Rig Mover, Barg Eng.
ABLE SEAMAN	2	2	2	3	1	4	2	Watchstander
ORDINARY SEAMAN	1	1	1	1	1	2	1	Roustabout
<u>CHIEF ENGINEER</u> SPECIAL INDUSTRIAL LIC				1	1	1		RMS
<u>ENGINEER</u> SPECIAL INDUSTRIAL LIC			2					RMS, RMS
ASSISTANT ENGINEER				1	2	1		
OILER			2	2	3	3		Motormen
<u>RADIO OFFICER</u> (IF REQUIRED BY FCC)				1	1	1		

<u>Notes:</u>
1. All moves of submersible and floating drill barges, most frequent type of move for jack-ups.
2. Most moves of drill ships, typical cf semi-submersibles.

FIGURE 4.3 USCG MARINE REQUIREMENT FOR MODUs (from Functional Job Analysis of Mobile Offshore Drilling Unit Operations, USCG, 1978).

Notes: - On drillships, Barge Engineers functions are performed by Master and Assistants
- The Barge Engineer has full responsibility for hull maintenance.
- Some individual serves as Radio Operator and Medic.

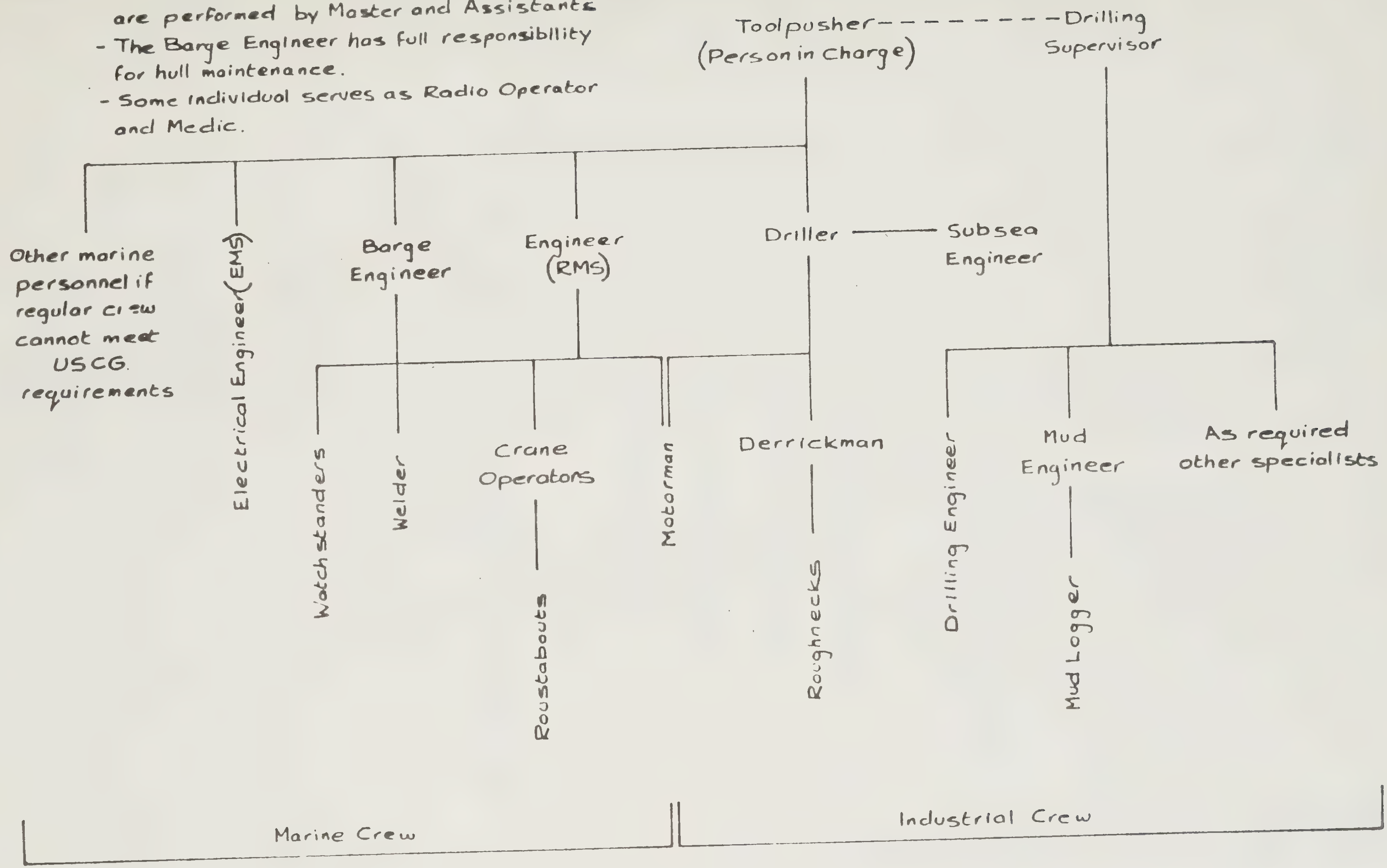

Fig 4.4 General Manning Arrangements For US. - Operated Semisubmersibles (Adapted from USCG 1978)

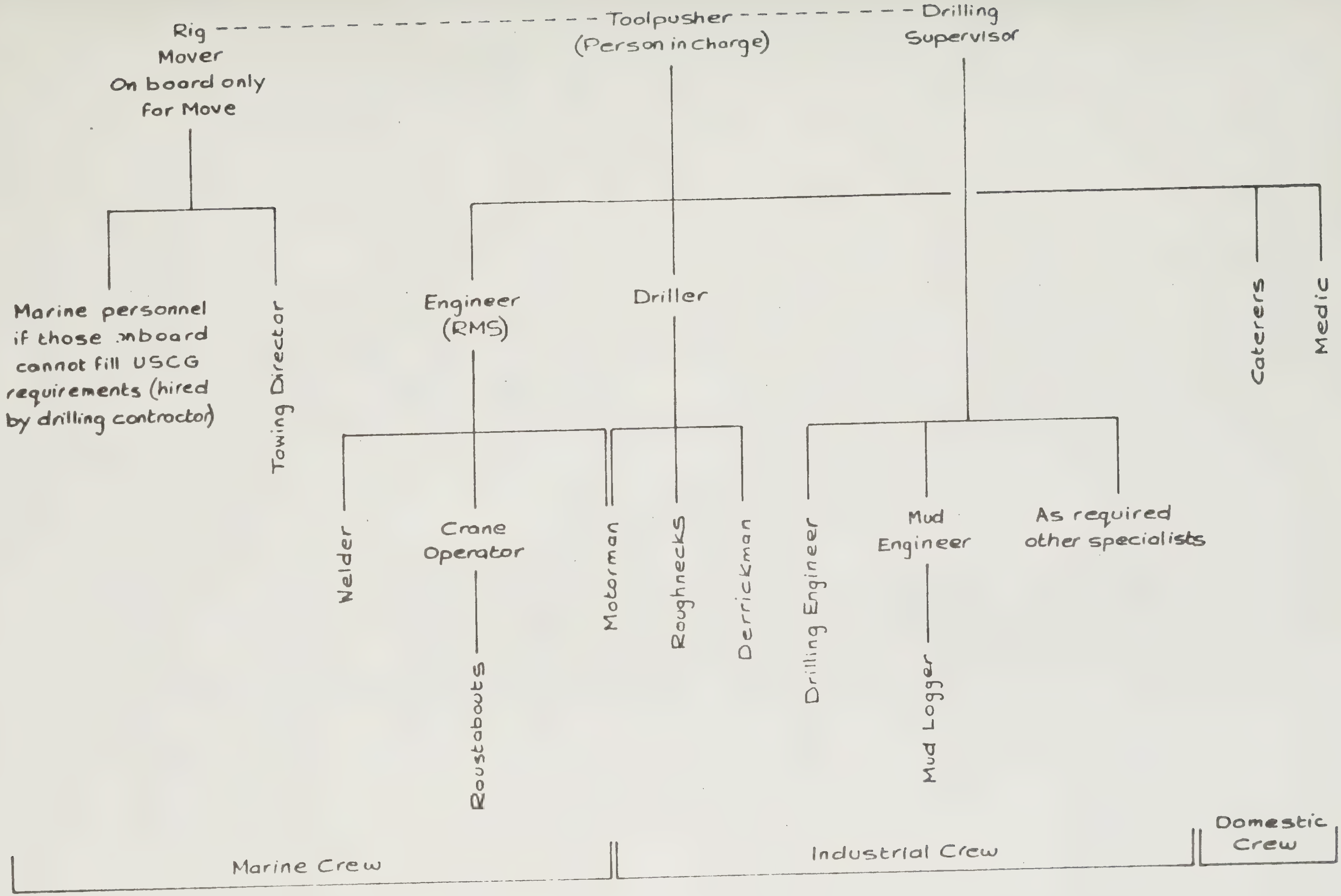

Fig 4.5 General Manning Arrangements For U.S.-Operated Jack-Ups (Adapted from USCG, 1978)

Drilling Superintendant
(lease operator's representatives)

Senior Toolpusher
(in charge of drilling, may be person in charge of the MODU, and immediate supervisor of the day tour)

Assistant Toolpusher
(in charge of night tour)

Two drilling crews (day and night) each with:

Driller

Assistant Driller

Derrickman

Mudman

3 or 4 Roughnecks (or Floormen)

Subsea Engineer
(on floating unit with subsea BOP)

Contractors service personnel as required. (ie cement crew casing crew, logging crew)

Fig 4 6 Typical Industrial Crew.

SECTION 5 - MARINE SUPPORT

5.1 Development Of Vessels And Operations

The marine support industry has developed in parallel with the offshore drilling industry to keep the drilling or production units supplied with drilling equipment consumables and people. Initially converted barges and tugs were used but during the last fifteen years, support vessels have undergone radical development, particularly in terms of horsepower, control systems, auxiliary thrusters, and bulk cargo arrangements. There has been considerable diversification towards specialized capabilities.

Offshore support vessel types being used today off Eastern Canada include supply vessels, anchor-handling vessels of which may be used for iceberg towing, and diving support ships. They range in length from 55 to 85 metres, with power ratings of 5,000 to 14,000 bhp. The lower rated vessels are used for surveying, supply or sometimes diving support. A variety of vessels are used as designated standby/rescue ships.

The machinery spaces in specialized support vessels are very complex, being equipped with the latest technology aimed at greater efficiency and reduced manning. Many of the engine room functions are bridge controllable. Only one Engineer is normally needed to man engine room spaces, but on some vessels an Electronics Technician is needed to operate, maintain and service the control and navigation equipment.

Supply Operations

Although supply is the task most like an ordinary marine operation, 'operations on supply vessel decks bear little or no resemblance to operations on a merchant vessel' (EASAMS Limited, 1982). Personnel have to work in rough weather on the exposed, low freeboard aft deck, working to a crane on another vessel which is also moving. In these circumstances, unloading heavy cargo, such as large diameter casing, can be extremely hazardous both to persons and vessels.

Until the last few years nearly all supply vessels would tie up stern to the rig, with one or two bow anchors placed about a quarter of a mile out to secure the bow of the vessel away from the rig. Many of the newer boats, having high horsepower engines and two-axis joystick control, can sit in position without mooring while discharging, using a combination of thrusters and main propellers. But North Sea experience is that if better mooring systems could be devised, mooring might always be preferable (EASAMS Limited, 1982).

Diving Support

When diving is taking place, the support vessel may be required to hold station close in to the MODU. Modern diving support vessels are equipped with computerised dynamic positioning systems, although diving operations are still carried out from anchored vessels and from MODUs.

When divers are working, particularly from a bell under saturation conditions, the vessel must remain on station within small tolerances. Weather and sea conditions must be accurately predicted and constantly monitored. Should an emergency arise, everything possible must be done to hold position at least until the divers are secured inside the bell.

Iceberg Towing and Anchor Handling

Vessel requirements for these tasks are very similar. The main need is for a high horsepower vessel with a bollard pull of at least 90 to 100 tons, equipped with suitable winches and cables.

The setting and retrieving of one vessel's anchors by another is an activity unique to offshore operations. Scheduled rig moves are not made in bad weather, but adverse conditions can arise during the operation. The capability to handle anchors in heavy seas must be maintained.

In iceberg towing, standard towing procedures are adapted to handle the enormous mass of most icebergs. Power must be applied very gradually once the towline is secured, and maintained over long periods to deflect the berg.

EASAMS Limited (1982) identified a number of hazardous aspects of anchor-related activities. The common practice of turning the vessel stern to the wind to retrieve an anchor buoy can be very dangerous to persons on deck in bad weather, because of the low stern of most support vessels.

Standby/Rescue

There is no consensus on the nature of the standby vessel or on the effectiveness of current standby services. In Eastern Canada, the vessel is generally a supply vessel and the vessels work in rotation between supply operations. Since November 1982, fast rigid inflatable rescue boats (FRBs) have been fitted on vessels working off Newfoundland and Labrador.

In the North Sea, the standby/rescue vessel is specially contracted and is often a converted trawler fitted with FRBs. Accommodation for all possible evacuees is required, and a medically trained person (beyond standard first aid) must be aboard. Rescue boat crews are usually specialists with some regular duties. In addition to initial training for vessel and boat crews, the oil companies insist on frequent practice offshore.

Other Vessels

Tankers, barges, pipe-laying and other highly specialized vessels were not considered, as they are not directly relevant to the exploration phase of offshore development.

5.2 Crew Roles And Training

There is very little, if any, overmanning on any support vessels. Key personnel are identified as those who make decisions that may

affect the safety of life or vessel, and supervise the execution of these decisions.

The job titles on support craft are conventional, but may not describe the work function accurately, depending on the role of the vessel, crew number and company policies. The crew are very much like a family, and all co-operate in carrying out the required work. The division between deck and engine departments is notably less rigid than is traditional on other merchant vessels.

Regulatory Requirements for Standard Canadian Crew

Canadian flag vessels are subject to the Deck Watch Regulations and the Safe Manning Regulations under the Canada Shipping Act. Foreign registered vessels in Canadian Territorial Waters are only affected by the former. The legal requirements for a vessel to transit Canadian waters under these regulations are a Master, a First Mate, a Second Mate, and sufficient personnel to maintain a three-person deck watch at all times. On vessels under 1,000 gross registered tons, the Second Mate is not required by regulations, as the Master can be considered available to be a person in charge of a deck watch. However, many such vessels do now carry a Second Mate.

Under the Safe Manning Regulations, all Canadian vessels must carry one person in charge of the machinery of the ship (Chief Engineer) and a Second Engineer.

There are other provisions in the regulations which, without specifying numbers, state that sufficient personnel must be aboard to handle fires and evacuations.

Additional Personnel

Companies employ other personnel for vessels' special tasks or features, principally DP Operators and Electronics Technicians on dynamically positioned ships.

A generalized list of key personnel includes the following:

- Master
- First and Second Mate
- Seaman*
- Chief Engineer
- DP Operator
- Electronics Technician
- Diving Supervisor**

* Although a seaman is not engaged to make normal operational decisions, he may carry out contingency procedures that warrant him to make a decision.

** Not a regular member of ship's crew, but the essential link person between Master and divers, during diving operations.

These roles will now be considered separately in regard to training legally required, training received in practice and that which is ultimately desired.

5.3 Key Personnel

5.3.1 Master

The role of the Master

The major aspect of the Master's position is command. He is responsible for planning the voyage, for ensuring everything necessary, including emergency equipment, is on board and operational, that all regulations and orders are fulfilled, that everything is 'ship-shape', and that the crew are appropriately trained and competent. Furthermore, he must maintain these conditions throughout the voyage, and ensure that the crew acts in accordance with good seamanship and safe working practices. The Master is alo responsible for ensuring that the mandatory boat and fire drills are carried out, and that current contingency plans (muster list, standing orders) are displayed.

Masters of support vessels control their ships more often than is normal on passenger or merchant vessels. In particular, they must manoeuvre in open seas and maintain stations close to the MODU, to moor or to off-load and back-load by snatching. By virtue of the equipment fitted - twin propellers and rudders (the latter sometimes independently controllable), bow and stern thrusters, joystick control systems - support vessels are much more manoeuverable than most cargo ships. The Master must be able to use these systems to the fullest to be effective.

If there is no Second Mate, the Master will take the deck watch on a six hours on, six off schedule. In addition, he will usually be on the bridge when the vessel is 'at the interface' with the MODU, either loading and discharging, handling anchors or towing icebergs. EASAMS Limited (1982) pointed out that protracted operation could be prejudicial to the Master's capability, and suggested that if this were envisaged, a Relief Master could be carried. Exchanging command at sea would require some minimal paper work, and is of course completely against tradition. Off the east coat, Masters have sometimes held station close to the MODU for longer than twenty hours.

Should an emergency threaten or arise, the Master makes the executive decisions and directs the crew to take the necessary actions. An emergency may threaten his own vessel, the MODU, other vessels or aircraft. As well as being bound in the charter agreement to aid the MODU, a vessel is obliged to assist any other vessel in difficulty by the 'law of the sea', and in Canada by the Canada Shipping Act. The Master of a designated standby vessel would normally request release from the Lease Operator's representative on board in order to leave station to render assistance.

In most merchant ships, the Master has the best first aid and medical training. In support vessels, since injuries are most likely to occur at times when the Master cannot leave the bridge, first aid should not be primarily his responsibility, but medical problems should be. Medical training for Canadian Masters, a

valid St John's Ambulance First Aid Certificate, is quite inferior to Britain's and Norway's. This is perhaps less critical for support vessels, which are usually in emergency airlift range, than for some other merchant vessels. The position will be improved when the MED III course for Masters, which includes CPR, is introduced.

During emergency situations, the Master generally assumes operational control of the vessel, and may manoeuvre it if it is fully bridge controllable. He will probably be appointed on-scene Commander (or Coordinator, Surface Search) in the event of an emergency evacuation of the MODU. He would then be responsible for establishing search patterns in conjunction with the Rescue Coordination Centre.

Finally, in the event of having to abandon ship, the Master would generally assume the role of Coxswain in one of the lifeboats.

The Training of Support Vessel Masters

Formal Training - Canada.

Masters are required to hold a Master Home Trade or ON I certificate. A fair proportion actually holds a Master, Foreign Going certificate. The training and experience necessary to acquire these is generally adequate for the routine operation of support vessels, and some aspects of emergencies, particularly those on board the vessel. The training does not address offshore support specifically.

Informal Training

Support vessel Masters in Canada usually acquire their skills on the job as mate. This is potentially a very good system under the right circumstances, but there is no present way to ensure that a Master has the necessary skills.

If an experienced Master is not available, shipping companies may commonly engage an experienced holder of a Mate's certificate, and request a temporary exemption.

Training in Other Jurisdictions

No requirement for training or certification over and above that normally required by the Master of a vessel of the class concerned could be identified in any of the countries studied.

Section 5.4 covers the Master's role on standby vessels.

5.3.2 Mate

The Role of the Mate

Almost all support vessels off Canada, except smaller supply vessels, carry two Mates. The First Mate is responsible under the Master for all deck operations - stability and watertight integrity, maintenance, life-saving/ fire-fighting equipment and training, anchoring, mooring, safety and working procedures for seamen. In addition, Mates are required to take a deck watch, during which time they have operational control of the vessel. This involves navigation, the use of radar and radio equipment and observing the 'rules of the road'.

In the marine support industry, the Mate is normally either on deck or on the bridge with a loud hailer during cargo transfer, anchor handling and iceberg towing, directing and supervising the seamen. Diving operations would normally not involve the Mate so directly, except in DP operations where Mates are usually DP operators.

The UK Department of Energy Study (EASAMS Limited, 1982) of support vessel operations observed that a Mate frequently carries out the most hazardous tasks personally. His main roles ought to be supervision and watching for hazardous situations.

The report also noted the occasional lack of radio communication between the Mate on deck and both the Master and MODU crane operator during supply operations. Standard hand signals give at best one-way communication, since the Mate cannot normally see the crane operator clearly. Radios are almost always used in the Eastern Canadian offshore, so the problem may be less acute.

In on-the-vessel emergencies (fire, man overboard, collision etc) the Mate normally leads the deck crew in countering the problem, under the direction of the Master. He thus needs to be skilled at firefighting, damage assessment, breathing apparatus, rescue operations and man overboard rescue operations. Again, however, there is a possible conflict between, for example, the Mate being the person most capable of effecting a rescue wearing breathing apparatus, and being the best person to remain outside to monitor the operation. It would be better if all seamen were trained in emergency duties.

The role of the Mate in special regard to Standby/Rescue vessels is discussed in Section 5.4.

In the event of having to abandon ship the Mate assists the Master in accounting for all personnel aboard, supervises the crew in preparing the craft for launching, and acts as coxswain for one craft (the Master being coxswain in the other).

The Training of Support Vessel Mates: Canada

First Mates on support vessels over 400 net tonnes must have at minimum an ON II certificate. On smaller vessels, they need only a Watchkeeping Mate certificate (WKM). Second Mates require only the WKM. These certificates provide a basis for offshore support work, with some inadequacies on specific aspects of the vessels and operations.

Informal Training

Experience as a Second Mate on a support vessel is a good method by which to learn these specifics, but not all vessels carry two Mates, and there is no present funding for supernumaries. Since there is no official recognition of the special role of support vessels, a requirement for experience is at the employer's discretion only. Canadian operators of support vessels prefer the Mate to have more than the legal minimum qualifications, but suitable persons are not always available.

Training in Other Jurisdictions

Training is much the same for Mates in most maritime nations. Other than for Standyby/Rescue duties, there is no special training for support vessel work, although in areas where the offshore oil industry is long established, the opportunities for on-the-job training are greater.

5.3.3 Boatswain and Seamen

The Role of the Boatswain and Deckhands

Boatswains and Deckhands perform most deck and cargo operations on a ship. They must often be able to act safely without reliance on supervision, especially in poor conditions.

The deckhand's normal duties include ship and lifesaving appliance maintenance, look-out duty and manning the helm, cargo securing and slinging, mooring, anchor and anchor buoy deployment and recovery, winch operation and other general duties. In emergencies, he may be expected to man hoses, pumps and fire extinguishers, to be a member of a rescue party, which may entail wearing breathing apparatus, and to aid in rescuing personnel from the water.

The Training of Deckhands: Canada

During the first years of support vessel operations off the east coast, Canadians were mostly employed as ratings.

A fair proportion of support vessel personnel now has considerable experience in the industry, some have progressed to Mates and Junior Engineers.

Experienced deckhands generally come from the merchant and offshore fishing fleets. There are aspects of work in both categories which are relevant to support vessel operations, but neither is fully sufficient. Some Masters prefer former trawler fishermen for their new deckhands since they feel that fishing experience in east coast waters on similar size vessels and in general open deck work may be quite close to that required. There are no formal requirements for a Canadian cargo vessel not in foreign trade to carry certified deckhands. In theory, anyone who is over 16 (with a health certificate if under 18) may be employed in this category. Nevertheless there are two certificates issued: Efficient Deck Hand (EDH) and Able Seaman (AB). Applicants for these certificates must now possess a valid MED II certificate.

Some institutions offer pre-sea, EDH and AB training courses, and new courses were recently introduced to meet IMO standards. After nine months at sea as an EDH, a seaman can sit the examinations as a Watchkeeping Mate, and may then be lost to his employer as a deckhand.

Other Jurisdictions

Deckhands working on support vessels in the UK North Sea are required to hold an EDH or AB certificate, and have three years deck experience, but not necessarily in the offshore industry. EASAMS Limited noted this lack of specific training and/or experience as a problem. Norway's situation is very similar. The US issues various grades of AB licence, but the standards are lower than in Canada and the UK.

5.3.4 Chief Engineer

The Role of the Chief Engineer

Most support vessels carry two Engineers, one Chief, one Second. Many of the following observations apply to both. The Chief Engineer is responsible (to the Master) for the maintenance and repair of all mechanical and electrical equipment and for engine room operations. In an emergency - fire and collision in particular - the Engineer must keep the vessel's systems operating as long as possible. They include bilge and ballast pumps, fire-fightng systems, engines and generators. He must also repair damaged equipment if possible. The Engineer is a key person in assessing whether or not damage from, for example, a collision could be temporarily repaired at sea and for carrying out those repairs.

The Training of Marine Engineers: Canada

There is an acute shortage of certified Marine Engineers in Canada (Transport Canada, 1982a). Holders of the First Class certificates are very scarce in the job market, so many vessels sail with Second Class certificate holders. This is all that is required by law on most vessels, but many shipowners would prefer a First Class holder.

Engineers graduate from Cadet or Diploma programs, or work as ratings before formal training. The former are comprehensive and provide considerable basic grounding, both in principles and in the ability to adapt to a particular vessel. The quality of training can vary widely.

It is as important for an Engineer to 'learn his ship' as it is for a Master. This is particularly true for modern support vessels, which have state-of-the-art control systems for engine room functions, as well as complex propulsion arrangements.

Regular training does not cover the technology of dynamic positioning. The Engineer is normally responsible for maintaining mechanical equipment relating to the DP system, such as the taut-wire referencing system. Instruction is normally available from the manufacturer or vendor of the system but there is no requirement for it to be taken.

Other Jurisdictions

The training of Marine Engineers is highly comparable in all western maritime countries. European schools prominently feature engine room simulators which are rare in North America.

5.3.5 Electronic Technician

Role of the Electronic Technician

This post is only found on the most advanced support vessels, fitted with full computer controlled dynamic positioning. Duties include maintaining this and the other electronic equipment - radar, navigation systems and engine room computers - and assisting the diving contractor as required.

The main emergency role is to maintain these systems under emergency conditions. A loss of DP capability when divers are operating is very hazardous to them and the Technician must restore the system rapidly under high stress.

Training of Electronic Technicians

There is no regulated structure for this post. Most ETs are graduates of diploma programs (two to three years), with additional manufacturer's training on specific equipment. Other jurisdictions operate in much the same way.

Haugesund Maritime High School in Norway has established a course for DP Operators. A simulator is used which can be adapted to various vessel types, including a 65m diving support vessel.

5.3.6 Diving Personnel

Due to the high medical component of diving safety, and to their greater personal knowledge, it was agreed that diving would be covered by the MEDICOR team studying Occupational Health and Safety. This report is concerned solely with the Diving Supervisor and his interface with the vessel crew.

The Role of the Diving Supervisor

In normal circumstances, the Diving Supervisor is responsible for the diving operation, working of the divers' life support and other equipment, and for ensuring that diving complies with the regulations of COGLA and the NLPD. He must also ensure that services from the vessel are within his requirements.

Two types of emergency can arise in connection with diving: a diving problem, with the vessel unaffected; and a vessel-related emergency while divers are working underwater. The Supervisor and Master will have established contingency plans, but each occasion will have its unique circumstances. The Supervisor must know what the Master can and cannot do with the vessel and its equipment, so that the plans can be modified to suit the situation.

Training of Diving Supervisors

Diving Supervisors must all have considerable experience as divers. This is now required under draft COGLA regulations. The general requirements are that the applicant has held the appropriate diver's certificate for three years, has been Assistant Supervisor on the category of dives for a specified number of dives during the preceding year, has a suitable letter of recommendation from one of a number of specified authorities and has passed an approved test, yet to be devised.

UK regulations require a Diving Supervisor to be a qualified diver in the techniques to be used, or to have acted as a Diving Supervisor over the same diving techniques during the previous two years. There is also a general requirement to be a competent person with adequate knowledge and experience of the relevant techniques.

The Diving Supervisor has the authority to refuse the start of, or request the termination of, any diving operation if he believes that the safety of the divers is threatened.

5.4 The Standby/Rescue Role

A standby/rescue vessel is legally required for fixed platforms and MODUs in the UK and Norwegian sectors of the North Sea, as well as for MODUs off the Canadian East Coast. Although the vessels used differ greatly, and the number of persons on production platforms is at least three times the number on exploration drilling units, the training needs of the crews in the two areas are very similar.

In a study for the UK Department of Energy, Hollobone Hibbert and Associates (1983) produced Draft Guidance Notes for standby/rescue vessels, which recommended additional crew members above the normal marine complement. Key personnel included a bridge plotter/radio operator to assist in search operations (could be second mate or additionally trained deckhand), and a dedicated rescue boat crew (three per boat), with the Coxswain responsible for maintenance of his boat. An age of 45 was considered a nominal maximum for rescue boat crews. The Department of Transport's Instructions for the Guidance of Surveyors in Certifying standby vessels have been revised to include some of the manning recommendations.

The rescue equipment on board varies between countries and capacities of standby vessels. Generally all carry scramble nets, boathooks, lifebuoys, extra lifejackets and searchlights. Today, all in the North Sea and most elsewhere carry up to three fast rescue boats (FRBs).

The use of this equipment, other than the FRBs, is not new to seafarers, but the best way of deploying it, particularly in bad weather, is the subject of much discussion and research.

There is no direct means of evacuation from an installation to a standby/rescue vessel. Its primary purpose is to rescue from the sea people who have fallen overboard or abandoned the unit. To be effective, it should maintain close proximity to the unit, ready to react quickly in an emergency. The Alexander L Kielland's standby/rescue vessel was six nautical miles away when the unit began to capsize and did not arrive on scene for about an hour. It failed to rescue any survivors while supply vessels at the scene were able to effect rescues (Inquiry Commission for the Alexander L Kielland, 1981).

The first action in an emergency is to locate personnel in the water, by standard marine techniques and by launching the fast rescue boats.

FRBs can cover a greater area than the vessel, but are low in the water, with a poor view of the sea. Also, crews cannot operate these craft continuously for long periods in severe conditions (three to four hours has been mentioned) without impairing their effectiveness and safety through fatigue.

Everyone on a standby vessel, at the time of an emergency, has a key role. A lack of training in any person could jeopardize themselves or the vessel, or result in the failure of the rescue task. Every person should have training for a specific role. Handling fast rescue boats in bad weather and recovering survivors from the sea require good training and regular practice. Besides the fast rescue boat crews, other crew members should be trained and drilled to launch the FRBs and to recover survivors from the water into the standby vessel, using the means available on the vessel. They should also be trained in first aid treatment of drowning and hypothermia, and the care of survivors. Some crew members should be specially trained in equipment maintenance, communication procedures and more advanced medical treatment.

Training in the UK and Norway

Standby/Rescue Vessel Crews

Two institutions, Robert Gordon's Institute of Technology, Aberdeen and Lowestoft College of Further Education, offer five-day courses for standby/rescue vessel crews. These are now mandatory. The courses are intended as an introduction to evacuation systems, search and rescue techniques, the use of rescue equipment installed on the vessels, co-ordination with helicopters, and casualty handling. Most platform operators arrange weekly exercises (sometimes without notice) with their standby vessel. The vessel crews also practise themselves.

Two companies operating standby/rescue vessels in the Southern UK sector have recently introduced cadet programs to ensure a continuing supply of trained and capable seafarers. The programs are run in collaboration with the Maritime Studies Department of Lowestoft CFE.

Fast Rescue Boat Crews

The two institutions above, plus Statens Havarivernskole in Haugesund, Norway, offer three to five day training courses in FRB operation. These courses are practical in nature, mostly involving boat and casualty handling, and boat maintenance. As with the vessel crews, the training is designed to enable offshore practice to be used to refine the practical skills. All three schools have FRBs. None has launching systems, since a dockside facility would probably not teach anything new to seafarers, and training is best done at sea with the equipment to be used.

The courses are intended to give basic instruction only. A high level of proficiency is then developed by practice offshore.

Norway has had regulatory training requirements for standby vessel crews since 1979 as laid down in Regulations concerning Standby Vessels in the Vicinity of Drilling Units, Installations and Facilities in Connection with Exploration, Drilling and Production etc of Submarine Petroleum Resources, 31 July 1979.

All crew members must have passed a basic First Aid Course, and at least two of them must have passed an advanced First Aid Course, both approved by the Directorate of Public Health.

At least three crew members must be especially equipped and trained to operate the fast man-overboard boat. Daily and weekly exercises to maintain training must be carried out and recorded.

Training in Canada

At present all Masters receive elementary training in search and rescue work as included in MED. A thorough knowledge of the MERSAR manual is also required for the Master's oral examination. The use of FRBs is not included in MED.

Vessels doing standby duty on the Grand Banks during the winter of 1982/83 were fitted with FRBs. A five day course to train the crews in FRB operation and casualty handling was set up at short notice. Half the timetable was occupied with first aid training. Difficulties were encountered in obtaining a boat for the courses. Each student had insufficient actual boat handling time. The personnel who attended these first courses were not adequately trained to operate fast rescue boats in offshore conditions, although the courses provided a basis on which further practice could build.

The statement on winter drilling made by the Newfoundland Provincial Minister for Mines and Energy on 5 November 1982 proposed that standby vessel crews should be required to receive on-site training based on the RGIT program.

Conclusions on Marine Support Training:

1. Masters and Mates of support vessels, in addition to their marine certification and experience, need training in some or all of the following topics, depending on the type of vessel on which they are employed:

characteristics of construction, stability, seakeeping, ballasting and cargo carrying arrangements of the specialized vessel;

ship handling and holding station by means of twin propellors, twin independent rudders and thrusters;

standby and rescue including deployment of fast rescue craft, and recovery of survivors from lifeboats, rafts and the water;

offshore cargo transfer, anchor handling;

iceberg towing;

diving support;

dynamic positioning;

MODU disasters, including blow-outs and maritime accidents.

2. All crew members regularly employed on support vessels should have the same level of training in basic safety and survival as MODU crews, including training on specialised life saving appliances not covered by MED II.

3. Deck hands who engage in certain hazardous offshore activities such as anchor handling, cargo transfer and iceberg towing should have specialist training and work under supervision until fully experienced.

4. Drills for seamen are essential for monitoring emergency skills. Changing scenarios are also essential.

5. Training for engineers is fairly satisfactory in terms of quality of content. The major problem in Canada is insufficient candidates for the senior levels.

6. Two possible areas for improvement in the content of engineers' training are: to keep training up to date with state-of-the-art technologies, and to offer specialist training in new technologies, as optional subjects.

7. For electronic technicians, the formal training available is satisfactory. The main requirement is for employers to hire competent persons and ensure they are trained for the specific equipment they will use.

8. Diving supervisors need prior knowledge of divers and diving, but training on the specifics of vessels and their equipment is best acquired on the job.

9. The role of the standby vessel has not been sufficiently defined for the necessary duties to be fully understood. The use of supply or anchor handling vessels in the secondary standby/rescue role means that, to provide an effective service, many more persons must be trained than if dedicated vessels are used.

10. The training of deck hands of vessels during standby/rescue duties off Eastern Canada is inadequate in the use of the specialized equipment, new techniques and handling large numbers of casualties.

11. A pre-requisite for standby/rescue vessel crews should be considerable seafaring experience, preferably on vessels of equivalent size.

12. A course needs to be developed which gives the crew a thorough grounding in standby/rescue duties.

13. On the job practice is essential, particularly where fast rescue boats are employed, so that the crew can operate to the limits of the craft in bad weather. A stable crew membership greatly enhances the effectiveness of this practice, by developing teamwork.

SECTION 6 - AIRCRAFT SUPPORT

6.1 Introduction

Air support for offshore drilling units in Eastern Canada is exclusively by helicopter, and since flying offshore is frequently under instrument flight rules, twin-engined aircraft are necessary. All aircraft are fully equipped for instrument flying in all weather, up to the operating limits allowed under the appropriate flight rules (Aeronautics Act). They also carry radar, homing equipment and electronic nagivation equipment.

6.2 Helicopter Crew

Government control of the air transport industry is extremely tight with regard to equipment, personnel and operations. The regulations impose detailed requirements on the training of pilots, for both initial qualification and regular recertification. Routine offshore helicopter operations require two qualified pilots, one of whom is the captain.

Cabin attendants are not mandatory even when more than 18 passengers are aboard, as the co-pilot has direct access to the passenger cabin. A passenger may be designated to be responsible for the emergency exit and liferaft deployment in the event of ditching. At least one helicopter company would like to carry a cabin attendant, but cannot afford the loss of payload unless it were a mandatory requirement for all operators.

Local offshore helicopters are all equipped to carry hoists. Hoists and rescue equipment are kept at their shore bases but no civilian or ex-CAF rescue specialists are employed. If a company were to mount a SAR operation, an engineer or a third pilot would volunteer for the responsibility of

operating the rescue system. An assistant might accompany him, but would not be lowered to help rescue casualties.

Air traffic controllers, maintenance crews and helicopter company ground personnel were not considered to come within the study Terms of Reference. Helicopter related personnel on MODUs are covered in Section 4. Thus the key personnel concerned in normal aircraft support operations are:

1. Aircraft Captain (and pilot)
2. Aircraft co-pilot.

On SAR operations, the key persons are as above, plus:

3. Rescue Hoist Operator
4. Rescue Assistant (possibly).

6.3 The Training Of Helicopter Crew

Pilot:

The main duties of the pilot are concerned with flying the aircraft, which is not the subject of this study. The other elements required for offshore industry support flying are discussed below.

Co-pilot:

The duties of co-pilot essentially duplicate those of the pilot, without the overall responsibility. Formal qualification requirements are virtually the same, the difference being in experience. The co-pilot must be prepared to take over command of the aircraft should the pilot be incapacitated.

Duties:

Additional safety and emergency related duties for a pilot and co-pilot in routine offshore support flying are:

- To ensure his own and co-pilot's familiarity with landing and take-off techniques for MODU concerned (pilot only).

- To ensure passengers are correctly seated and wearing immersion suits, hearing protection and life vests.

- To administer (verbally or via tape) on-board safety briefing to passengers.

- To operate electronic navigation equipment and weather radar, keep radio watch and make regular check-in calls to shore dispatcher or radio operator on MODU (usually co-pilot).

- To notify MODU of approach and receive local weather condition report (usually co-pilot).

- To be prepared to handle in-flight emergencies such as machine or instrument failure, engine or equipment fire, cabin fire, sudden illness of passenger or co-pilot, emergency landing at sea or on land.

- To be prepared to take command of evacuation of helicopter and subsequent survival, particularly in life-raft at sea, including maintaining liferaft, treating injuries, operating emergency location equipment, maintaining morale and discipline.

6.3.1 Qualification, training and experience

All pilots must comply with the legal requirements for certification, which are rigidly controlled (Air Navigation Order Series VII No 6), and must undergo regular proficiency checks on instrument flying and aircraft type. In addition the helicopter operators may impose additional standards.

The three main helicopter operators in the region, two of whom presently service the offshore petroleum industry, were consulted. They generally require considerable experience from pilots before permitting them to fly offshore. One company requires pilots joining it to fly for at least six months in onshore VFR conditions, regardless of previous experience, until satisfied with their performance. The pilot will then fly as an offshore co-pilot until there is a consensus between the management, Chief Pilot and Training Captain that he is capable of commanding an aircraft for offshore operations.

6.3.2 Emergency Training

Other areas of competency in which aircrew should be proficient are covered in less detail than flying operations. There is a regulatory requirement in the Air Navigation Orders (Series VII, No 6) for operators to establish drills for emergency procedures, and to ensure that they are carried out 'except where it can be shown that emergency functions can be adequately learned by demonstration'.

Firefighting : None of the companies provides fire-fighting training other than that covered in the aircraft type rating check, which is primarily the fixed systems for engine or instrument panel fires.

If a fire occurs in flight, the pilots are extremely busy with the aircraft; the general procedure is to land and evacuate. Over the open ocean, if the fire is a small one in the cabin, this may not be the best initial approach. The extinguisher can be used effectively, even by a passenger if he were trained as part of his offshore employment. Cabin extinguishers are small, hand held units powered by dry nitrogen.

First Aid : Provision of first aid training varies. One company requires all its pilots to hold St John's First Aid certificates, and attend the company's course which concentrates on helicopter accident injuries. The other two companies do not arrange first aid training though a few of their pilots have had some coincidentally.

Helicopter Underwater Escape Training (HUET) : None of the companies provides this at present. Expense is a major problem, since no local facilities are available for Newfoundland operations.

Survival : All three companies now provide practical survival training for their aircrew. Lengths vary from one to three days.

6.3.3 Comparison with other areas

Basic helicopter pilot training is broadly comparable in most areas of offshore oil exploration. Standards are high and regulation is strict. Most aircrew in the North Sea do have underwater escape, survival and first aid training.

6.4 Training for Rescue Work

6.4.1 Rescue operations

Hoisting casualties into a helicopter is very demanding and dangerous work. Careful planning and adherence to procedures can reduce the problems. Team work is vital; each crew member must be highly proficient in his own role, and must know fully the responsibilities of the others.

The most efficient method is to deploy a rescue technician (SARTECH in the armed forces vocabulary). This job demands a high state of fitness, expertise and experience. Armed forces SARTECHs can parachute, rappel, dive and render paramedic help, amongst many other skills. Commercial operators do not employ such personnel at present.

Rescue can also be achieved using passive techniques. Foremost are the Billy Pugh Net and USCG rescue basket, but opinion is divided over which is best. Both are limited as to the conditions under which they can be deployed. In particular, the Billy Pugh Net cannot rescue an incapable casualty.

A new piece of equipment is being introduced by some oil companies, the EMPRA basket. This cargo hook mounted device is designed to scoop up to twenty people from the water, and land them on the nearest vessel. Pilots have some reservations as to its effectiveness, since casualties cannot be taken aboard but must stay in the airflow, while being flown to safety; and that if more than twenty people climb into the basket, the aircraft may not be able to lift it and may have to jettison.

6.4.2 Rescue duties

The principal duties of the aircrew members during a rescue are as follows:

<u>Pilot</u>

To command aircraft

To maintain overall awareness of the situation

To ensure all crew understand requirements and are capable of responding

To fly aircraft during final approach, rescue and departure.

Co-pilot

To maintain overall awareness of the situation and be prepared to assume pilot duties
To assist pilot by monitoring instruments and radio, with particular reference to rescue coordination
To be prepared to activate emergency cable cutter.

Hoist operator

To be in command of cabin and occupants
To perform checks of hoist and rescue gear
To inform pilot of conditions of cabin hoist, rescue site and survivors, continuously
To direct pilot during final approach, hover, scooping operations if using a basket, and departure
To observe clearances on door side of aircraft during above stages and inform pilot
To operate hoist to deploy rescue gear (or technician)
To confirm technician safety harness OK before exit
To deploy markers and survival equipment as required.

Assistant or Rescue Technician

To assist hoist operator in checking equipment
To assist hoist operator in getting casualties into aircraft and controlling them
To administer first aid as required
To observe clearance for other side of aircraft during final approach, hover and departure
If qualified and capable, to descend on hoist to assist casualties into rescue equipment
To be prepared to relieve hoist operator.

6.4.3 Rescue training

Details were obtained of one local helicopter operator's rescue training course. Instruction was provided by members of 103 Rescue Unit. The curriculum is shown below:

Day 1 - Ground Training (Classroom)

Company hoisting operations procedures

Sea survival
- type specific ditching procedures
- liferaft survival
- survival equipment

First Aid (under sea survival conditions)
- bleeding
- artificial respiration
- shock
- hypothermia
- equipment

Day 2 - Ground Training (in water)

Pyrotechnic signalling devices (practical)

Use of liferaft and equipment

Immersion suits and flotation devices

Day 3 - Hoisting (practical)

Hoisting work, rotating through positions as pilot, hoist operator and survivor

Billy Pugh Net, rescue basket, horse collar.

Pilots, as well as hoist operators, did the hoist operator training, to promote teamwork.

6.4.4 Comparison with other areas

In the North Sea, government search and rescue coverage is vastly superior to the Eastern Canadian area,

particularly the Grand Banks and Labrador, because of greater resources and lesser distance. Nevertheless, several operators maintain quite extensive search and rescue capabilities, either in multi-platform fields or where operations are in 'remote' areas. The capability in BP's Forties field is an example.

Forties has four production platforms, with up to about 200 persons on each. They are attended by the Iolair, a semi-submersible emergency support vessel. A small helicopter (Aerospatiale Dauphine) is permanently kept in the field as an inter-platform shuttle, with provision for its use in search and rescue operations. Rescue equipment is maintained on two platforms. Helicopter company personnel operate the hoist, and BP employees act as SARTECHs. These latter are volunteers from among the platform personnel and are not expected to perform all the duties of service SARTECHs. They train with the helicopter crews to practise descending on cable and assisting casualties into baskets or horse collars. BP has found them very effective in working with casualties in the water, or during evacuations from decks of supply and fishing vessels. They have some extra training as medical escorts, for transporting casualties to shore, but are not trained divers or paramedics.

In the North Sea, even government SAR teams had great difficulty landing the SARTECH on a lifeboat in 3.5m seas and 35 kt winds. Provided the lifeboat is intact, it may be safest to leave the casualties in the boat until the weather improves.

6.4.5 Discussion

The capability exists for Canadian commercial helicopters to mount SAR operations, at least under daylight VFR conditions. On the night the Ocean Ranger

sank, the helicopters on charter to Mobil did fly out, and at least one other company's pilots voluntarily went to standby status with rescue equipment, but they were not called upon by RCC Halifax. The Cross Report (Cross, 1982) concluded that much better use could be made of private sector facilities by the government rescue system. The companies' major concerns are: should they be requested to assist in a search and/or rescue operation, who would pay the direct operating costs (fuel etc) and what would be the insurance arrangements for machine and crew? If these were established in principle, companies would be willing to participate.

Conclusions on Aircraft Support

General:

1. Regulations for aircrew training are strict and basic flying training for helicopter crews, coupled with operating company requirements for experience are adequate.

2. Canadian SAR services are not adequate for the vast offshore area and have to be supplemented by operating companies' helicopters, which are less well equipped for rescue and do not have specially trained crews.

3. Local offshore helicopters are equipped to carry hoists, which together with other rescue equipment are held ready onshore.

Canadian needs:

1. All round emergency training should be considered for the crew, especially HUET and inflight cabin fire fighting. No facilities yet exist for HUET.

2. Survival and first aid training for crew members would enable them to deal with emergencies, while awaiting assistance.

3. At present no formal training courses in rescue exist, although some companies provide their own capabilities. Consideration needs to be given to the provision of SARTECH training of civilian personnel, if the military SAR capability cannot be developed.

SECTION 7 - GENERAL CONCLUSIONS

In this report conclusions have been drawn on training in various aspects of offshore activity. In addition to the conclusions specific to MODUs, and their marine and aircraft support, there are some factors which affect all offshore training in the Eastern Canadian region. These are set out below:

1. Environmental conditions off Eastern Canada are bad, with rough weather, fog and the possibility of icebergs and pack ice.

2. The area of operation can be far from shore and quite isolated.

3. Training is needed for aspects of safety, rescue and general operation. This needs to take into account the specifics of the harsh and isolated region.

4. Canada has a history of marine training and land based drilling training, with important and reputable establishments. Some of these have developed training for offshore or MODU operations.

5. A representative national (or at least an East Coast) forum, enabling operators, contractors and training establishments to discuss and establish training standards with national and provincial Governments would help ensure that the training met with general acceptance with respect to standards and economy.

6. Good training is expensive - full size equipment and elaborate simulators are needed for some aspects of offshore training. A means for funding further developments needs to be established. At the same time it must be born in mind that expenditure on training can increase to any amount available, and suitable controls need to be established.

7. Government recognition of courses and qualifications, with proper monitoring, helps to ensure high standards and wide acceptability.

8. Regulations or other Government legislation may be needed to achieve some of the necessary results.

9. Regular drills are needed to keep the training fresh in the minds of all personnel.

APPENDIX A
ORGANIZATIONS CONSULTED

Aberdeen Technical College, Aberdeen, Scotland

Alberta Petroleum Industry Training Centre, Edmonton, Alberta

Ansul Fire School (Wormald Nederland Groep) Ar Lebystad, Netherlands

Australian Maritime College, Tasmania, Australia

Bennex A/S, Bergen, Norway

Bergen Maskinistskole, Bergen, Norway

Bergen Sjomannskole, Bergen, Norway

Bow Valley Offshore Drilling Ltd., Halifax, N.S.

BP Exploration Canada Limited, St. John's, Newfoundland

BP International Limited, Southampton, England

BP Petroleum Development (UK) Ltd., Aberdeen, Scotland

British Columbia Ferry Corporation, Victoria, British Columbia

British Petroleum Company plc., London, England

British Telecom International, London, England

Camuson College, Victoria, British Columbia

Canadian Association for Oilwell Drilling Contractors, Calgary, Alberta

Canadian Merchant Service Guild, Ottawa, Ontario

Centre for Remote and Offshore Medicine, St. John's, Nfld.

College of Fisheries, Navigation, Marine Engineering and Electronics, St. John's, Newfoundland

College of Nautical Studies, Southampton, England

College of Trades and Technology, St. John's, Newfoundland

Colne Group, Lowestoft, England

Company of Master Mariners of Canada, Vancouver, British Columbia

Conoco (UK) Ltd., London, England

Crosbie Offshore Services, St. John's, Newfoundland

Dalhousie Ocean Studies Program, Halifax, Nova Scotia

Dowell Canada, Calgary, Alberta

Eastcoast Petroleum Operators' Association, Calgary, Alberta

EMPRA Systems Group, Vancouver, British Columbia

Fenco (Newfoundland) Ltd., St. John's, Newfoundland

Government of Canada
Canada Employment and Immigration Commission
Canadian Coast Guard
Canada Oil and Gas Lands Administration
Department of Communications
Department of National Defence
Department of Transport, Civil Aviation Transport Authority

Government of Denmark
Directorate for Maritime Education

Government of Newfoundland and Labrador
Department of Education
Department of Labour and Manpower
Newfoundland and Labrador Petroleum Directorate

Goverment of Norway
Norwegian Maritime Directorate
Norwegian Petroleum Directorate

Government of Sweden
National Swedish Administration of Shipping and Navigation

Government of the United Kingdom
Department of Energy, Petroleum Engineering Division
Department of Trade, Marine Division
Her Majesty's Coast Guard
Royal Navy Survival Equipment School

Government of the United States
Department of the Interior, Minerals Management Service
Department of Transport, Coast Guard
Federal Communcations Division

Halliburton Energy Institute, Duncan, OK, USA

Harding Safety A/S, Rosendal, Norway

Haugesund Maritime Hogskole, Haugesund, Norway

Haugesund Mekaniske Verikdted A/S, Haugesund, Norway

Helmer Staubo A/S, Oslo, Norway

Holland College (Waterfront Centre), Charlottetown, PEI

Houston Marine Training Services, Houston, TX, USA

Institut de Marine du Cégep de Rimouski, Quebec

International Association of Drilling Contractors, Houston, TX

Internation Association for Sea Survival Training, Aberdeen, Scotland

International Federation of Shipmaster's Association, London, England

International Maritime Organization, London, England

Lowestoft College of Futher Education, Lowestoft, England

Maritiem Instituut "De Ruyter", Vlissingen, Netherlands

McMillan Offshore Survival Technology, LaFayette, LA, USA

Mobil Exploration Norway Inc., Stavanger, Norway

Mobil North Sea Limited, London, England

Mobil Oil Corporation, New York, USA

Nautisch College "Noorder Haaks", Den Helder, Netherlands

Neddrill (Nederland) BV, Rotterdam, Netherlands

Newfoundland Ocean Research and Development Cooperation, St. John's, Newfoundland

Niagara College of Applied Arts & Technology
MED Training Centre, Port Colbourne, Ontario

Norske Industriforening for Operatorselskaper, Stavanger, Norway

North Sea Medical Centre, Great Yarmouth, England

Norwegian Underwater Technology Centre, Bergen, Norway

Norwich Airport Fire Training School, Norwich, England

Nova Scotia Nautical Institute, Halifax, Nova Scotia

Ocean Air Services, St. John's, Newfoundland

Offshore Petroleum Industry Training Board, Montrose, Scotland
Drilling and Production Technology Training Centre
Offshore Fire Training Centre

Otis Engineering Ltd., Dallax, TX, USA

Pacific Marine Training Institute, Vancouver, British Columbia

Petroleum Extension Service, University of Texas at Austin, TX, USA

Petroleum Industry Training Service, Calgary, Alberta

Petroleum Training Association (North Sea), Lowestoft, England

Putford Enterprises Ltd., Lowestoft, England

RA Safety and Training Inc., Houston, TX, USA

Robert Gordon's Institute of Technology, Aberdeen, Scotland

Rogaland Distrikts Hogskole, Stavanger, Norway

Safety Offshore Project, Trondheim, Norway

Scottish Offshore Training Association, Aberdeen, Scotland

Seafarers Training Institute, Morrisburg, Ontario

Sealand Helicopters Ltd., St. John's, Newfoundland

Shell UK Exploration and Production Ltd., Aberdeen, Scotland

Shell UK Exploration and Production Ltd., London, England

Ship Research Institute of Norway, Oslo and Trondheim, Norway

South-Eastern Drilling Company (SEDCO), Dallas, TX, USA

Sparrow's Training Centre, Aberdeen, Scotland

Star Offshore Services Marine Ltd., Aberdeen, Scotland

Statens Havarivernskole, Haugesund, Norway

Statens Sjoaspirantskole, Bergen, Norway

Statens Treningssenter for Skipsmanovring, Trondheim, Norway

Stavanger Maritime College, Stavanger, Norway

Surres Society, Helsinki, Finland

Survival Systems Ltd., Dartmouth, Nova Scotia

Texas A & M University, Engineering Extension Service, College Station, TX, USA

Trondheim Maritime Skole, Trondheim, Norway

Watercraft America Inc., Edgewater FLA, USA

Whittaker Corporation, Survival Systems Division

Wolf Offshore Transport, St. John's, Newfoundland

Zapata Offshore Company, Houston, TX, USA

APPENDIX B
GLOSSARY

AB	Able Seaman.
AES	Atmospheric Environment Service.
APOA	Arctic Petroleum Operators Association
API	American Petroleum Institute.
B/A	Breathing Apparatus.
BCO	Ballast Control Operator.
bhp	Brake horse power.
BILLY PUGH NET	A small net in the form of a seat lowered for rescue purposes from a helicopter.
BLOWOUT	An uncontrolled flow of gas, oil, or other well fluids into the atmosphere. A blowout, or gusher, occurs when formation pressure exceeds the pressure applied to it by the column of drilling fluid.
BLOWOUT PREVENTER (BOP)	Equipment installed at the wellhead at surface level on land rigs and on the seafloor of floating offshore rigs to prevent the escape of pressure either in the annular space between the casing and drill pipe or in an open hole during drilling and completion operations.
BLOWOUT PREVENTION CONTROL (BOP) PANEL	A set of controls, usually located near the driller's position on the rig floor, that is manipulated to open and close the blowout preventers.

BLOWOUT PREVENTER CONTROL UNIT	A device that stores hydraulic fluid under pressure in special containers and provides a method to open and close the blowout preventers quickly and reliably. Usually compressed air and hydraulic pressure provide the opening and closing force in the unit.
BOST	Basic Offshore Survival Training (training recommendation of OPIC).
BOT	Basic Offshore Training (training recommendation by an EPOA/APOA safety task force).
BP	British Petroleum.
CAF	Canadian Armed Forces.
CAODC	Canadian Association of Oilwell Drilling Contractors.
CASING	Steel pipe placed in an oil or gas well as drilling progresses to prevent the wall of the hole from caving during drilling.
CCG	Canadian Coast Guard.
CEIC	Canada Employment and Immigration Commission.
CFE	College of Further Education.
CHARTER PARTY	A contract between the owner of a ship on one hand and the owner of a cargo or some other person on the other.
CLASS 7 VESSEL	A non-passenger vessel engaged in international voyages.
COGLA	Canada Oil and Gas Lands Administration.

CONTINUOUS TASK	A task involving continuous repetition of a movement pattern that has no discernible beginning or end.
CPA	[1]Canadian Petroleum Association. [2]Closest point of approach.
CPR	Cardio-pulmonary rescusitation.
DECK WATCH	That part of the complement that is required for the purpose of attending to the navigation or security of a ship.
DP (DYNAMIC POSITIONING)	A system for keeping a vessel in a particular location at sea by the use of multi-directional thrust, and using a location referencing system.
DRILLING FLUID	The circulating fluid, one function of which is to force cuttings out of the wellbore and to the surface.
DRILL SHIP	A ship constructed to permit a well to be drilled from it at an offshore location. While not as stable as other floating structures (e.g. a semi-submersible), drill ships, or shipshapes, are capable of drilling exploratory wells in relatively deep waters. They may have a ship hull, a catamaran hull, or a trimaran hull.
EDH	Efficient deck hand.
EPOA	East Coast Petroleum Operators Association.
FRB (FAST RESCUE BOAT)	A small open craft designed for rescue purposes, which is capable of exceeding 25 knots in calm water.
FREEBOARD	The vertical distance between the waterline and the lowest non-watertight level on a ship, boat, or floating offshore drilling rig.
HLO	Helicopter Landing Officer.

HOVER	To maintain the position of a ship or helicopter while under power.
HORSE COLLAR	A harness placed round a person for rescue purposes.
HUET	Helicopter Underwater Escape Trainer.
HYDROGEN SULPHIDE	A gaseous compound, H_2S, of sulphur and hydrogen commonly found in petroleum, which causes the foul smell of sour petroleum fractions. It is extremely poisonous and corrosive.
IADC	International Association of Drilling Contractors.
IFR	Instrument Flight Rules.
IMO	International Maritime Organization.
JACK-UP DRILLING RIG	An offshore drilling structure with legs that support the deck and hull. When positioned over the drilling site, the legs rest on the seafloor. A jack-up rig is towed or propelled to a location with its legs up. Once the legs are firmly positioned on the bottom, the deck and hull height are adjusted and leveled.
JOYSTICK	A single lever proportionally controlling movement in more than one axis. On DP vessels the manual control for thrust in any horizontal direction.
KICK	An entry of water, gas, oil, or other formation fluid into the wellbore. It occurs because the pressure exerted by the column of drilling fluid is not great enough to overcome the pressure exerted by the fluids in the formation drilled. If prompt action is not taken to control the kick or kill the well, a blowout will occur.

KILL	1. In drilling, to prevent a threatend blowout by taking suitable preventive measures (e.g. to shut in the well with the blowout preventers, circulate the kick out, and increase the weight of the drilling mud). 2. In production, to stop a well from producing oil and gas so that reconditioning of the well can proceed.
LEASE OPERATOR	The company (usually an oil company) which is responsible for managing a drilling program.
LEIRO	G. Leiro was the head of a Norwegian committee investigating training for offshore personnel. The committee's recommendations have formed the basis of Norwegian requirements for basic emergency training.
LSA	Life Saving Appliances.
MARINE EMERGENCY DUTIES II MED II	Course established by the Canadian Coast Guard.
MEDICOR	The Centre for Remote and Offshore Medicine at Memorial University of Newfoundland.
MERSAR	Merchant Ship Search and Rescue (manual).
MOB	1 Man overboard. 2 Man overboard boat, a boat designated for readiness to rescue persons falling overboard.
MOBILE OFFSHORE DRILLING UNIT (MODU)	A unit used exclusively to drill offshore wells that may be moved from one location to another. The drill ship, semi-submersible drilling rig, and jack-up drilling rig are all mobile units; a platform rig is not.

MOONPOOL	The hole through the decks of a ship or drilling unit through which the drilling is done. Also applies to similar arrangements on diving support vessels.
MUSTER LIST	A posted list designating the locations to which personnel aboard a vessel must report on hearing the emergency signals. It may also note their responsibilities in an emergency.
NIFO	The Norwegian Offshore Operators' Association.
NLPD	The Newfoundland and Labrador Petroleum Directorate.
NMC	The Norwegian Martime Directorate.
NPD	The Norwegian Petroleum Directorate.
OPIC	The Offshore Petroleum Impact Committee.
OPITB	The Offshore Petroleum Industry Training Board.
PACKAGED INSTRUCION	Instructional material designed to be used for self-study, in a series of units, with or without testing. Slides, videotapes and printed materials may be used, singly or in conbination.
PERSON IN CHARGE	The person aboard a MODU who has final authority and responsibility for the safety of those onboard.
PETANS	The Petroleum Training Association (North Sea). An association of companies and schools active in working or training for the Offshore petroleum industry.

PETEX	The Petroleum Extension Service of the University of Texas at Austin.
PITB	The Petroleum Industry Training Board in the UK, now transformed into OPITB.
PITS	The Petroleum Industry Training Service, based in Calgary, Alberta.
RCC	Rescue Coordination Centre.
RGIT	Robert Gordon's Institute of Technology in Aberdeen, Scotland.
RGMC	Radiocommunication Operator's General Certificate (Maritime).
ROG	Radiotelephone Operator's (General) Certificate.
ROR	Radiotelephone Operator's (Restricted) Certificate.
ROUGHNECK	A worker on a drilling or workover rig, subordinate to the driller; sometimes called a rotary helper, floorman, or rig crewman.
ROUSTABOUT	A worker who assists the foreman in the general work around producing oil wells, usually on the property of the oil company. A roustabout may also be a helper on a well-servicing unit or one who does utility work on an offshore drilling rig.
RULES OF THE ROAD	Internationally agreed rules for avoiding collisions at sea.
SAR	Search and Rescue.
SARTECH	Canadian Armed Forces designation of person trained in search and rescue techniques, other than pilots: the personnel who are lowered from helicopter or parachute into rescue site.
SAW	Supplementary Aeronautical Weather. AES designation for systematic weather observation and recording for aircraft operations.

SCOTA	Scottish Offshore Training Association.
SECTOR CLUB	Emergency resources coverage of the North Sea devised and operated by the Offshore Operators' Associations in the coastal nations.
SEMI-SUBMERSIBLE DRILLING RIG	A floating offshore drilling structure that has hulls submerged in the water. Living quarters, storage space, and so forth are assembled on the deck. Semi-submersible rigs are either self-propelled or towed to a drilling site and either anchored or dynamically positioned over the site or both.
SNATCHING	Transferring cargo between the MODU and a supply vessel while the supply vessel is hovering adjacent to the platform, and not moored.
SOFA	Safety-oriented first aid.
STABILITY	The property of a floating object to return to an upright position after being made to roll or pitch by external forces.
STANDBY/RESCUE VESSEL	A vessel designated to remain close to a MODU to provide a rescue capability. Various specifications of vessel capabilities and rescue equipment are found in different countries. Non-rescue standby roles include anchor handling and iceberg towing.
STANDING ORDERS	Basic rules for operation of a vessel issued by Owner and/or Master. Usually valid at least for voyage or charter. Often standing orders must be signed by officers to acknowledge their awareness.

APPENDIX C

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